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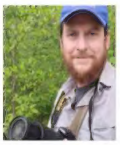
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Outgoing Executive Officers at the 2024 Meeting

Thank you for your service

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Purpose

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

Time and Place of Future Meetings

2025 Myrtle Beach, SC
March 12- 15

The View from Here: A Message from the President

It is a privilege to serve as the President of ASB, and I am most grateful for the opportunity to report on the status of our Association. We continue to hold an outstanding Annual Meeting, which supports student and professional attendees from across the Southeastern United States. In fact, at the 2024 Chattanooga meeting, we had the largest attendance in more than 10 years – a testament to the fine scientific work being conducted in our region and to the dedication of all the faculty and students who share this research with our community. Our meeting began with the R.H. Martin Plenary Address by Dr. Karen Lloyd, who engaged us with insight into "What Lies Beneath" and the incredible microbial ecosystems that literally underpin life on Earth. Her journeys to the depths of the ocean and to hot springs around the world have revealed incredibly long-lived microbial communities whose ecological timescale is a daunting testament to survival. Dr. Lloyd's address was extremely well-received by attendees, and was made possible, in part, by the generous support of the RH Martin family. The kindness of the Martin family, in combination with ASB general meeting funding, allows us to invite outstanding scientists like Dr. Lloyd, who both encourage and inspire attendees with the quality of their scientific endeavors.

We are continuing to see that most of the attendees at our Annual Meeting are students. For many students, attending ASB is the first professional meeting of their careers; to help defray the cost of meeting attendance for undergraduate and graduate students, ASB offers a number of Support Awards. These awards are funded through a variety of mechanisms, including the very popular "Silent Auction;" our special thanks to Dr. Rebecca Cook, along with Dr. Dawn Wilkins and Dr. Jennell Tally, for their longstanding commitment to this important fundraiser, which sponsors Annual Meeting attendance for a number of students each year. We are committed to growing support mechanisms for student attendance at ASB, so please do consider donating - either items for the Silent Auction at our Annual Meeting or to our Support Fund, which accepts monetary donations year-round. Advancing the pipeline of students and early career professionals is an important role of our Association; thank you in advance for your support.

The success of ASB 2024 was enriched by our amazing group of Featured Institutions, beginning with the University of Tennessee, Chattanooga and continuing with Dalton State University and Georgia Highlands College. Our meetings benefit tremendously from the partnership of our Featured Institutions, and we deeply appreciate their participation. Our Affiliate Organizations also contribute their time and energy to our Annual Meeting, sponsoring networking opportunities, funding awards for both poster and oral presentations, in addition to providing financial support for student attendees. Special thanks to Spring Wildflower Pilgrimage, bbb Districts I and II, SABS, the Southeast section of BSA, the Southeast chapter of ESA, the Southeast chapter of SHC and NABT. Year after year, our Featured Institutions and Affiliate Organizations go the extra mile, helping to make our meeting vibrant and wonderfully diverse; as you read through this year's edition of Southeastern Biology, please take a minute to notice and appreciate all they do.

Organizing a professional meeting requires the collaboration of many, but no group contributes more than the Executive Committee (EC) of ASB and no individual is more responsible for our Annual Meeting success than our fabulous meeting planner, Shannon Oliphant-Gordon. It is my honor to work with this fantastic group of professionals, who expend countless hours on our Association's behalf, planning the Annual Meeting. Like all ASB Committees, the EC members volunteer their time and expertise. The work of the EC is extensive, and year-long; it involves reviewing Symposia and Workshop proposals, engaging with our terrific Exhibitors, researching potential Plenary speakers, considering Abstract submissions, organizing the Annual meeting program, facilitating the judging of presentations, and so much more. I hope you will consider serving on the EC, or another ASB Committee; your time and talents are needed, and the work is valuable, professionally and personally.

Occasionally, the President of ASB chooses to comment on issues of import to our organization. One such issue arose in March of this year, when news of the planned closure and attempted "rehoming" of the Duke Herbarium was communicated to the ASB Executive Committee. Our Association supported the effort to persuade Duke University to maintain, intact and in place, their more than one hundred-year-old collection, with the statement below:

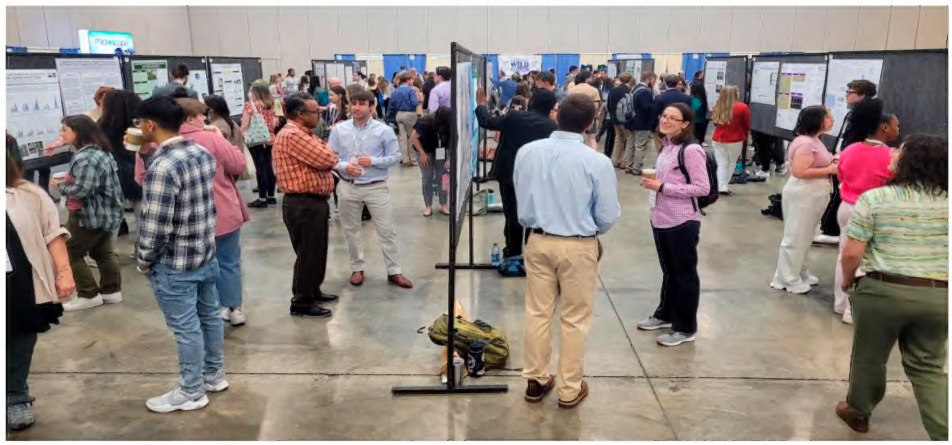
"The Duke University herbarium contains over 800,000 herbarium specimens from around the world. The collections serve as a resource not just for faculty and students at Duke University, but also for innumerable institutions across the southeastern United States. At a time when we are experiencing a global mass extinction event, the closure of a major herbarium in the southeastern United States, a global biodiversity hotspot, will be a serious blow to future students of biodiversity research."

As biologists, we empirically bear witness to the continuing impacts of anthropogenic activity on the organisms and ecosystems we study; natural history collections are vital to understanding the scope of these changes. I hope you will join me in urging Duke University to find a way forward that retains the integrity and diversity of this fine collection.

As we move to Myrtle Beach for ASB 2025, I encourage each of you to submit your abstracts, applications for support awards, and nominations for Career Awards a bit earlier than usual. Our Myrtle Beach meeting, March 12-15, will necessitate earlier deadlines; we will communicate these dates well in advance and you can also consult our Calendar for more information. We look forward to another well-attended gathering of biologists from across our region and thank you for your continuing commitment to ASB.

See you in Myrtle Beach!

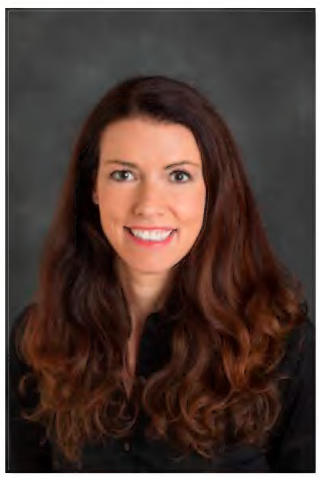
Holly Boettger-Tong, ASB President



Featured Institutions At ASB 2024

Thank You For Your Support!

ASB 2024 R.H. Martin Plenary Session
Dr. Karen Lloyd



Dr. Karen G. Lloyd is currently a Professor at the University of Tennessee and will be the Wrigley Professor of Earth Science at the University of Southern California starting August 2024. Her lab uses molecular biological techniques and geochemistry to study the diversity and functions of microbial life in the deep-sea, mud volcanoes, subseafloor sediments, methane seeps, terrestrial volcanoes, hot springs, serpentinizing springs, Arctic fjords, and ancient permafrost. Much of her work focuses on exploring how individual microbial cells may live for thousands of years in these deep subsurface realms.

About the R.H. Martin Plenary

Robert H. Martin, founder and owner of Martin Microscope Company from 1946 until his death in 2006, was an avid supporter of ASB and of the sciences in general. He supported ASB for decades as a Patron member and sponsor of the ASB Student Research Award, and, with his passing, his family established what has become the Robert H. Martin Plenary Address fund to help cover the costs of bringing in highly qualified speakers for the ASB annual meeting.

ASB 2024 Patrons and Sponsors

THE UNIVERSITY OF TENNESSEE CHATTANOOGA

Martin Microscope .com

Dennis, Breedlove, and Associates, Inc.
Winter Park, FL

Dwayne Wise,
Mississippi State University

There are many ways to support ASB's mission to provide high-quality opportunities for biologists across the southeast to present their work, network with peers, and develop professionally.

Find out more on our website:
https://www.sebiologists.org/sponsors--exhibitors.html

2024 Affiliate Organizations

NABT
National Association of Biology Teachers

SPRING WILD FLOWER PILGRIMAGE
Wildflowerpilgrimage.org

Southern Appalachian Botanical Society

Botanical Society Of America
Southeast section

SHC-SEUSA · Southeastern United States Chapter of the Society of Herbarium Curators

ECOLOGICAL SOCIETY OF AMERICA
esa
Southeast chapter

Districts I and II

2024 Exhibitors

AWARDS PRESENTED AT THE 2024 ANNUAL MEETING IN CHATTANOOGA

CAREER AWARDS

ASB JOHN HERR LIFETIME ACHIEVEMENT AWARD

This prestigious award recognizes unusually significant contributions by its members to the life of the Association and to biology in the southeastern US. The award is given in honor of Distinguished Professor Emeritus John Herr (Department of Biological Sciences, University of South Carolina)

Dr. J. Whitfield ("Whit") Gibbons
Professor Emeritus of Ecology
University of Georgia
Savannah River Ecology Laboratory

LUCRECIA HERR OUTSTANDING BIOLOGY TEACHER AWARD

Presented to the recipient of the National Association of Biology Teachers' Outstanding Biology Teacher Award from the Host State

Jessica Minton
Houston High School

ASB SUPPORT AWARDS

THE LAFAYETTE FREDERICK UNDERREPRESENTED MINORITIES SCHOLARSHIP	**Aleen Ammar**	University of North Carolina, Asheville
SUPPORT AWARDS FOR FIRST-GENERATION UNDERGRADUATE STUDENT MEMBERS OF ASB	**Edgardo Cruz**	University of Memphis
	Paris Fouche	University of Memphis
	Mariah Mattison	University of Memphis
	Kaitlin Moseley	Campbell University
	Amber Whitten	Wesleyan College
SUPPORT AWARD FOR GRADUATE STUDENT MEMBERS OF ASB	**Anne Sciolino**	Virginia Commonwealth University
	Caitlin Say	Virginia Commonwealth University
	Chelsea Thornton	University of South Alabama
	Emily Riffe	Virginia Commonwealth University
	Jianing Liang	Mississippi State University
	Kelly O'Neil	University of Memphis
	Olufemi Fatunsin	University of Alabama
	Rylee Strassner	Appalachian State University
	Samantha Drewry	University of Memphis
	Edward Long	Virginia Commonwealth University

ASB RESEARCH AWARDS

ASB STUDENT RESEARCH AWARD
Sponsored by Martin Microscope

Ashleigh Woods
Wesleyan College

ASB PRESENTATION AWARDS

ASB STUDENT POSTER PRESENTATION AWARD – ANIMAL BIOLOGY	**Josie Scordato**, Wesleyan College "The dawn chorus in the Georgia Piedmont in relation to environmental variables"
ASB STUDENT POSTER PRESENTATION AWARD – AQUATIC BIOLOGY	**Amber Whitten, Ashleigh Woods**, Wesleyan College "Comparative effects of linalool and linalyl acetate on Betta splendens agonistic behaviors"
ASB STUDENT POSTER PRESENTATION AWARD (Tie) – CELL AND MOLECULAR BIOLOGY	**Gavriel Burger**, Florida Gulf Coast University "Identification of anti-metastatic compounds in triple-negative breast cancer"
	Mariam Iskander, Christian Yang, Lipscomb University "Characterizing Neprilysin's regulation of the PI3K pathway in triple negative breast cancer"
ASB STUDENT POSTER PRESENTATION AWARD – MICROBIOLOGY	**Deborah Roh**, Mercer University "Enhancing antimicrobial efficacy and biofilm inhibition using MXene nanomaterial-based coatings on medical devices"
ASB DR. FLOYD SCOTT AWARD FOR THE BEST POSTER PRESENTATION IN HERPETOLOGY	**Peyton Kinavey,** Coastal Carolina University "The cryptic creatures: Determining habitat occupancy of pine snakes (*Pituophis melanoleucus*) using environmental DNA"
ASB STUDENT ORAL PRESENTATION AWARD – ANIMAL BIOLOGY	**Rin Pell,** University of Memphis "Context-dependent costs and benefits to cowbird parasitism in Prothonotary Warblers"
ASB STUDENT ORAL PRESENTATION AWARD – AQUATIC BIOLOGY	**Jon Daniel**, Furman University "Effects of lithium and cobalt on algal symbiont density in Exaiptasia diaphana anemones"
ASB STUDENT ORAL PRESENTATION AWARD (Tie) – **CELL AND MOLECULAR BIOLOGY**	**Alexis Deloach**, Wofford College "Evidence for phosphate-dependent control of symbiont cell division in the model anemone Exaiptasia diaphana"
	Breana Walton, Augusta University "Using force-sensitive domains to produce synthetic receptors in Drosophila"
ASB STUDENT ORAL PRESENTATION AWARD – MICROBIOLOGY	**Lauryn Faulkner-Sitton**, Mary Baldwin University "Cryptosporidium infection in cattle based on water source, age and gender"
ASB DR. FLOYD SCOTT AWARD FOR THE BEST ORAL PRESENTATION IN HERPETOLOGY	**Elizabeth Strasko**, Western Kentucky University "Measuring spatial and temporal variation in species composition of ephemeral pond amphibian assemblages using metabarcoding"

AFFILIATE AWARDS PRESENTED AT THE 2024 MEETING

NORTH CAROLINA BOTANICAL GARDEN AWARD

Lauren Willhite, North Carolina State University
"Long-term survivorship and species invasion post-restoration on Rocky Branch"

SOUTHEAST CHAPTER OF THE ECOLOGICAL SOCIETY OF AMERICA – TRAVEL AWARDS

Olufemi Fatunsin, University of Alabama
Lauren Pharr, University of Tennessee
Subash Saptoka, University of Louisiana, Munroe
Zac Spicer, Appalachian State University

SOUTHEAST CHAPTER OF THE ECOLOGICAL SOCIETY OF AMERICA – EUGENE P. ODUM AWARD

Kelly O'Neil, University of Memphis
"Cheaper by the dozen? Effects of brood size on provisioning dynamics and parent-offspring conflict in a wild songbird"

SOUTHEAST CHAPTER OF THE ECOLOGICAL SOCIETY OF AMERICA – ELSIE QUARTERMAN-CATHERINE KEEVER AWARD

Mackenzie Wallace, Wesleyan College
"Hourly and seasonal patterns of visitation and sociality of Eastern Bluebirds at an artificial water source"

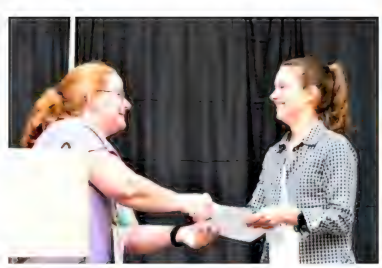
SOUTHERN APPALACHIAN BOTANICAL SOCIETY – Conference Support Awards

Sam Cleary
Sarah Durham
Erica Edinger
Skyler Fox
Elysaa Ghazali
Lauren Gray
Kaitlyn Harless
Leigha Henson
Alan Huff
Emma Jarrell
Kate Loughran
Clara Minnich
Jonathan Osborne
E.G.Postal
Kaya Rosselle
Sydney Svoboda
Cameron Tinsley
Aspen Warrillow
Lauren Willhite

SOUTHERN APPALACHIAN BOTANICAL SOCIETY – EARL CORE STUDENT RESEARCH AWARD

Skyler Fox, Georgia Southern University
"Evaluating trampling effects on plant communities in a restored sand dune ecosystem"

Kate Loughran, Appalachian State University
"Secrets of the Swamp: Uncovering the genetic diversity of a federally threatened wetland species, swamp pink (*Helonias bullata*)"



SOUTHERN APPALACHIAN BOTANICAL SOCIETY – OUTSTANDING STUDENT ORAL PRESENTATION AWARD

Julia Prins, University of Tennessee, Chattanooga
"Modeling Subnational Conservation Status Ranks for Tennessee Vascular Plants"

SOUTHERN APPALACHIAN BOTANICAL SOCIETY – OUTSTANDING STUDENT POSTER PRESENTATION AWARD

Skyler Fox, Travis Williams & Lissa Leege, Georgia Southern University
"Evaluating the success of a dune restoration on Tybee Island, Georgia: monitoring sand movement and plant community dynamics"

SOUTHERN APPALACHIAN BOTANICAL SOCIETY – ELIZABETH ANN BARTHOLOMEW AWARD

Dr. Joey Shaw, University of Tennessee, Chattanooga

SOUTHEASTERN SECTION OF THE BOTANICAL SOCIETY OF AMERICA – OUTSTANDING STUDENT POSTER AWARD IN PLANT SCIENCE

Kaya Rosselle, North Carolina State University
"Dominant Seed Dispersal Modes of Invasive Plants in a Restored Urban Stream"

SOUTHEASTERN SECTION OF THE BOTANICAL SOCIETY OF AMERICA – OUTSTANDING STUDENT PAPER AWARD IN PLANT SCIENCE

Meredith Woodward, University of Tennessee Chattanooga
"The State of Herbaria in Tennessee"

ASB Symposia

SYMPOSIUM: Fire History and Fire Effects in Southeastern U.S. Ecosystems—Implications for Management

Thomas Saladyga, Concord University, Athens, WV and Kyle Palmquist, Marshall University, Huntington, WV

166 - Pine Woodland Fire Dynamics Since Industrialization (ca. 1870s) at the New River Gorge, West Virginia

Thomas Saladyga[1], Stockton Maxwell[2], Douglas Manning[3]

[1]Concord University, Athens, WV, [2]Radford University, Radford, VA, [3]National Park Service, Glen Jean, WV

Fire is an important biophysical process in pine and mixed pine-oak forests and woodlands across the Central and Southern Appalachian Mountains. Decades of fire exclusion, however, particularly on state and federal lands, have resulted in a well-documented homogenization of species composition and forest structure. Fire histories reconstructed from trees scarred by past wildfire events are often used to provide context for science-based management decisions, including the reintroduction of fire to these landscapes. Our objective in this study was to build a network of pine woodland fire history sites at New River Gorge National Park and Preserve (NERI) and adjacent Babcock State Park in southern West Virginia that will provide context for fire management plans. We dated more than 200 fire scars in 110 samples collected from *Pinus pungens* (n = 7), *P. rigida* (n = 22), and *P. virginiana* (n = 81) trees distributed across four site areas. The fire-scar record spans 169 years, with the earliest fire scar recorded in 1842 and the most recent in 2010; however, sample depth diminishes rapidly prior to the 1870s. Fire occurred every 3-7 years on average at each site before NERI was established as a national river in 1978, while relatively few fires were recorded by trees after the 1970s. At the landscape scale, fires were most extensive in the 1880s-1890s and in the 1960s. Fires occurred most frequently, however, in the 1930s-1940s, which coincides with a major pulse in pine establishment as well as the period of peak human population density just before the collapse of the local mining industry. Our results indicate that fire has been on the landscape since at least the mid-19th century and that socioeconomic transitions have played an important role in pine woodland fire dynamics at the New River Gorge during the last 150 years.

167 - Should the forests of the future look like the forests of the past in the Sauratown Mountains of N.C.

Dane Kuppinger, John Guglielmetti, Esprit Cha

High Point University, High Point, NC

Since the end of blanket fire suppression policies, conservationists have relied upon prescribed fire to restore and preserve xeric vegetation communities. But what should this fire prescription look like? For the North Carolina Sauratown mountains, the answer may rely more upon aesthetics than data. Most of the Sauratowns are contained within Pilot Mountain and Hanging Rock State Parks. The fire history built from 199 samples collected at Pilot Mountain covers the pre-suppression (1825-1927), suppression (1930-1980), and post-suppression (1981-2022) periods. At Pilot Mtn., the decadal fire index, mean fire interval, and mean fire size all dropped significantly during the suppression period and while they increased after suppression, they remain lower than in the pre-suppression period. In all three periods, drought (as measured by PDSI) was not significantly correlated with fire probability and no recent fires of significant size have been caused by natural ignitions. Collectively these data suggest that fire at Pilot Mountain has been primarily anthropogenic in origin for the last 200 years. Recent data from Hanging Rock supports these findings. Initial samples were collected in 2022 and the Flat Shoals section was intensively sampled in 2023. Compared to other areas of Hanging Rock, Flat Shoals samples contain a much higher frequency of fire scars and visibly scarred trees were more abundant across the ridge. Flat Shoals greater similarity to Pilot Mtn. than the rest of Hanging rock again suggests the dominance of anthropogenic fires and immediate land use practices in determining each area's distinctive fire history. Though the presence of *Pinus pungens* at all locations indicates a history of fire, without historical records or fire scarred trees from a period before extensive human alterations of the fire regime, land managers are left without a dataset to guide them.

168 - Let er Rip: High Severity Fire and the Tree Ring Record in Southeastern Forests

William Flatley

Department of Geography, University of Central Arkansas, Conway, AR

This talk will consider tree ring evidence for fire as a woody-tree limiting or canopy removing ecological process in the southeastern US. I will provide examples from studies of tree rings that characterize fire disturbance and tree establishment during recent centuries in two ecosystem that are important within the broader ecology of this region: 1) yellow pine-oak forest in the Appalachian Mountains and the Ouachita Mountains and 2) yellow pine-cedar-oak glade complexes in the Ouachita Mountains and the Ozark Plateau. I will present fire history, age structure, patterns of tree-ring growth and maps from several sites, with the goal of illustrating fire's role in limiting the establishment of a woody canopy and preventing compositional, structural, and functional change in these systems. The forests and glades with a reconstructed fire record exhibited frequent fire, 2-15 year mean fire return intervals. The sites normally burned during the dormant

season and showed evidence of a range of fire severities. During the 20th century, the absence of fire at almost all of the forest and glades sites coincided with rapid tree establishment and the initiation of forest succession. The direction and pace of succession differed across the sites, but the general patterns are that oaks and hickories replaced shortleaf pine on sub-xeric to xeric sites and juniper dominated establishment in formerly treeless glades and barrens representing the edaphically limited sites. There is still much that we do not know about the historical role of fire in shaping landscapes of the southeastern US. However, this tree-ring evidence suggests that fire played an important role in shaping vegetation in yellow pine-oak forests and cedar-oak-glade ecosystem types. This information can help aid managers as they restore and maintain these ecosystems.

169 - Breeding bird response to fire and other disturbances in eastern hardwood forests

Cathryn Greenberg

USDA Forest Service, Asheville, NC

Historically, natural and anthropogenic disturbances in eastern hardwood forests maintained a heterogeneous landscape, with variable levels of canopy cover. Today, prescribed fire is used to restore disturbance-adapted plant communities, and presumably the associated wildlife. However, little is known about wildlife response to prescribed fire or wildfire variability in eastern hardwood forest, especially over a relatively long time period (i.e., >10 years). In this talk I present overviews of multiple, multi-partner short- and long-term studies that together address breeding bird responses to single or repeated low- and high-severity prescribed fire, mixed-severity wildfires, season of burning, wind disturbance, shelterwood harvests, and other silvicultural treatments in the southern Appalachians. Together, study results indicate that bird abundance and species richness increases in response to forest canopy reduction, whether by high-severity burns, wind disturbance, or shelterwood harvests. Increases are due to an influx of disturbance-adapted species, with little change in the abundance of most species associated with mature forests. In general, breeding bird communities show little change in response to low-severity prescribed burns or wildfire, or silvicultural midstory reductions if canopy cover is left intact. In the short-term, substantial forest overstory reduction by timber harvests or high-severity burns may be required to create forest conditions suitable for disturbance-dependent species.

170 - Can't See the Savanna for the Trees: Describing the Lost Oak Savannas of the Black Belt Ecoregion

Jared Gorrell[1], Alan Weakley[2,3], Dwayne Estes[1]

[1]Southeastern Grasslands Institute, Clarksville, TN, [2]University of North Carolina Herbarium, Chapel Hill, NC, [3]Southeastern Grasslands Institute, Chapel Hill, NC

Shortleaf pine-post oak-blackjack oak savanna woodlands are among the most imperiled natural communities in eastern U.S. A review of the US National Vegetation Classification (USNVC) revealed 38 associations, of which 78 percent have a G1-G3 global rank. Within the East Gulf Coastal Plain Ecoregion, only two associations are recognized and poorly circumscribed. Available USNVC descriptions indicate "presumably this association was more open in the past, with more frequent burning." And "due to fire suppression, large areas of this type have been lost." We sampled 20 savanna-woodland remnants at the 11,000-acre Sumter Farm & Stock Company, a private farm in Sumter Co, Alabama. The farm has been burned nearly continuously since the 1910s. It contains one of the only examples of multi-hundred-acre scale, intact, fire-maintained, high-quality savanna-woodlands within the Black Belt ecoregion. These savanna-woodlands are dominated by post and blackjack oaks along with shortleaf pine. We hypothesize these pine-oak savanna-woodlands should harbor high numbers of conservative heliophytic species and low numbers of residual forest-conservative species, which would indicate these are relictual old-growth communities vs. recent early-successional communities. To test this, we employ the Conservative Heliophyte Index (CHI) as a first test-case scenario. Conservative heliophytes tend to depend on fire or other natural disturbance for the open habitats they require and are thus a proposed metric for habitat quality in grasslands and grassland-related (e.g. woodlands) communities. We will discuss potential benefits and issues with the current fire regime used at this site.

171 - The effects of fire frequency on mixed-oak forest plant communities of southeastern Ohio

Kyle Palmquist[1], Todd Hutchinson[2], Rebekah Shupe[1], Moses Shafer[1], Khyla Johnson[1], Pamela Puppo[1]

[1]Marshall University, Huntington, WV, [2]USDA Forest Service, Northern Reasearch Station, Delaware, OH

In fire-adapted ecosystems, frequent fire promotes biodiversity and enhances regeneration of pyrophilic species by increasing resource availability and reducing competition with mesophytic species. As a result, prescribed fire is now widely implemented, following widespread fire suppression policies of the 20th century. Our goal was to quantify the effects of fire frequency on: oak regeneration, herbaceous layer species richness, and floral resources for bumblebees over a 25-year period in southeastern Ohio. In 2019 and 2022, we re-sampled mixed-oak forest plots established in 1995 that were part of a fire frequency experiment with three treatments: control (unburned), periodic fire (5 fires), and frequent fire (7 fires). In each plot, all vascular plant species were recorded within each of 16 2 m^2 quadrats, along with the number of buds, flowers, and fruits (floral abundance) for each species and tree seedling density. Sapling density for each species was determined in 312.5 m^2. We calculated changes in seedling and sapling density, and species richness through time, along with floral abundance for species known to be used by bumblebees, and related those variables to fire frequency and environmental variables using mixed effects models and generalized linear models. Oak seedling density increased slightly from 1995 to 2019 on burned sites, while oak sapling density increased substantially in a small number of xeric sites with periodic fire. Species richness increased from 1995 to 2019 and changes in species richness were significantly positively related to fire frequency ($p<0.01$, pseudo $R^2 = 0.34$). Increases in species richness were driven primarily by recruitment of perennial graminoids and forbs. In 2022, floral abundance was significantly higher in sites with periodic and frequent fire (29 / m^2) , relative to control sites (13 / m^2, $p<0.01$). These results indicate multiple ecological benefits of prescribed fire in mixed-oak forests of southeastern Ohio.

SYMPOSIUM: Southeast Chapter of the Ecological Society of America – Climate change ecology in southeastern systems

Jennifer Boyd, University of Tennessee at Chattanooga, Chattanooga, TN

Introduction

152 - Adaptive and acclimatory capacity of southeastern endemic plants in the face of climate change

Jennifer Boyd

University of Tennessee at Chattanooga, Chattanooga, TN

The enduring question of why some species are rare while others are common has important implications for the conservation of rare species and overall biodiversity. In the context of both current constraints to their ranges and their responses to rapid rates of contemporary environmental change, rare species can be limited in their capacities to adapt or migrate due to low genetic diversity and/or fitness as is suggested by previous research and our recent meta-analytic work. While the ability of rare species to acclimate also could influence their current rarity and responses to environmental change, this capacity has been relatively underexplored in rare species. To compare the capacity of rare versus common species to adapt acclimate, we investigate and compare the population-level genetic diversity and phenotypic plasticity of individuals of rare endemic species of the southeastern USA, such as *Boechera perstellata* (Braun's rockcress) and *Pityopsis* ruthii (Ruth's golden aster), with that of their widespread congeners. In contrast to our predictions that rarity would be associated with both adaptive and acclimatory constraints, we have found rare species to exhibit relatively high phenotypic plasticity in response to changes in light and water availability. However, rare species are constrained in their ability to acclimate to temperature. Overall, our findings elucidate the narrow range and habitat restrictions of rare endemic species of the southeastern USA and suggest their vulnerability to future environmental change.

153 - The Effects of a Changing Climate on Endangered Species: A Study with the Red-cockaded Woodpecker

Lauren Pharr

North Carolina State University, Raleigh, NC

Over the past several decades, densities of the endangered Red-cockaded Woodpecker (*Picoides borealis*; hereafter RCW) have increased due to intensive restoration and management of longleaf pine forests and the strategic placement of artificial cavities; their recovery is so successful that the United States Fish and Wildlife Service is considering downlisting the species from an endangered to threatened status. We used data from long-term nest monitoring of the RCW to understand current trends in reproduction at 3 three locations: the Sandhills region in south-central North Carolina, Marine Corps Base Camp Lejeune on the central coast of North Carolina, and Eglin Air Force Base on the Gulf Coast in the western panhandle of Florida. We found that RCWs are initiating laying earlier, with much larger clutches early in the season. In North Carolina, the larger clutches are not resulting in higher productivity due to elevated partial brood loss. However, in the southwestern portion of the range increases in clutch sizes do not compensate for elevated partial brood loss; we predict this resulting declining productivity may be due to a changing climate, and a preview of the future for this species in North Carolina.

154 - Effect of Climate Change on the Winter Activity of Bats in the Cumberland Gap Region

LaRoy Brandt

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As bats are often considered bio-indicators in many regions of the world, they are likely to be directly affected by human-mediated climate change. As with many other animals, the gradual increase in global temperatures is likely to have significant impacts on bat physiology, behavior, phenology, distribution, migratory patterns, and much more. Currently in its third year, this project focuses on the potential impact of climate change on the winter activities of bats inhabiting the Cumberland Gap Region in using stationary, passive ultrasonic recorders to monitor bat foraging activity. Beginning in 2020, fifteen Song Meter Bat passive recorders (Wildlife Acoustics) were placed at various locations in the region known to have bat activity during summer months. Each year of the study, recorders are placed from 15 October to 15 March and programmed to record nightly beginning 30 mins prior to sunset until 30 mins after sunrise the following day. The batteries for each recorder were refreshed every 4 weeks. All recordings were subsequently processed using Kaleidoscope™ analysis software (Wildlife Acoustics) to identify bat species based on their echolocations used when foraging. Song Meter Bat recorders also measure ambient temperature at the time of each audio recording. From the recording, dates of winter activity and the ambient temperature at the time of recording were summarized for each species. This data not only provides a list of species that are active during the wintertime but also may identify species-specific minimum ambient temperatures for winter activity. It is expected that continued long term monitoring for a total of ten years will likely identify trends of bat winter foraging activity that will correlate with the increasing temperatures associated with climate change.

84 - Spatial Modeling of Ecological and Environmental Drivers of Forest Biomass in Southeastern United States

Olufemi Fatunsin

University of Alabama, Tuscaloosa, AL

Understanding the complex interplay between ecological and environmental drivers of forest biomass is crucial for effective forest management and biodiversity conservation. This study explores this interplay in the southeastern United States by integrating forest attributes, climate variables, and terrain characteristics. Advanced modeling techniques, including Geographical Weighted Regression (GWR) and hotspot analysis, were employed to capture spatial heterogeneity and local regression coefficients specific to each site. Our analysis revealed significant relationships between ecological attributes (Shannon tree structural diversity, species diversity) and environmental factors (temperature, precipitation, hillshade) and aboveground biomass distribution. Notably, hillshade emerged as a significant predictor of aboveground biomass at select locations. Precipitation and temperature positively influenced aboveground biomass at 39% and 55% of sites, respectively, while negative effects were observed in 44% and 42% of sites, respectively. Similarly, tree structural and species diversity positively impacted aboveground biomass in 31% and 40% of sites, respectively, with contrasting effects in 39% and 46% of locations, respectively. Our findings contribute to filling a critical knowledge gap by elucidating the individual and synergistic effects of ecological and environmental attributes on forest biomass distribution. They provide valuable insights into the spatial variability of biomass distribution, informing targeted forest management strategies in the southeast region of the United States.

155 - Unlocking Nature's Resilience: Leveraging Plant Genetic Diversity and Belowground Microbial Associations to Enhance Plant Stress Tolerance

Melissa A. Cregger, María del Rosario Ramírez-Flores, Alyssa Carrell, David Weston, Dawn Klingeman, Miranda Clark, Sara Jawdy, Dana Carper, Leah Burdick, Miguel Rodriguez Jr, Attelia Hollander, Ann Wymore, David McLennan

Oak Ridge National Laboratory, Oak Ridge, TN

Climate change plays a key role in exacerbating drought conditions worldwide. Over the last two decades, the world has seen a rapid increase in the frequency and intensity of drought events, leading to profound impacts on ecosystems and posing significant challenges to plant growth. New research is highlighting the role that symbiotic host–microbe interactions play in plant growth and in how plants respond to abiotic and biotic stress. Harnessing diversity within these plant–microbe associations in managed ecosystems, provides an opportunity to create sustainable, multipurpose bioeconomies whereby globally important plant feedstocks can be produced while simultaneously maximizing soil health and mitigating adverse impacts to climate. Therefore, to increase ecosystem sustainability, we aim to leverage genetic variation in plant hosts to select for plants that are tolerant to abiotic stress and pair these plants with belowground microbial partners to alter plant performance and ecosystem processes. Specifically, our research leverages a suite of molecular, physiological, and ecosystem level techniques and experiments to identify natural variation within diverse genotypes of *Populus* and characterize associated microbial communities under varied environmental conditions. As we identify these complex associations, we aim to build *Populus*-microbial associations within ecosystems that alter plant growth, plant tolerance to drought, and ecosystem carbon cycling.

156 - Crop rotational diversity as a climate adaptation strategy

Katherine Muller[1], K. Ann Bybee-Finley[1], Virginia Sykes[2], Frederi Viens[3], Harry Schomberg[1], Kathryn White[1], Eunjin Han[4], Michel Cavigelli[1], Tim Bowles[5], Sieglinde Snapp[6]

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Long-term experiments provide valuable insights about how agricultural systems respond to changing climate. The DRIVES Project (Diverse Rotations Improve Valuable Ecosystem Services) has combined legacy yield, weather, and management data from 21 long-term agricultural experiments throughout North America to investigate how cropping system diversity affects resilience to climate change. We will present findings from our cross-site analysis, focusing on two sites managed by the University of Tennessee. The long-term experiments in Milan and Spring Hill, TN compare cropping sequences of corn, soybean, and/or cotton (Milan only) managed with cover crops, poultry litter, or fallow as fertilizer inputs. Our analysis uses 18 years of crop yield and weather data to quantify how cropping system diversity mediates system resilience to adverse weather events. A preliminary analysis without weather data showed that diverse rotations tended to outperform simpler rotations in years with low overall yield (due to poor conditions). This suggests that rotational diversity can serve as a climate adaptation strategy by improving crop system resilience to adverse weather.

157 - Identifying and protecting climatic refugia in Florida at multiple spatial scales

Reed Noss[1,2], Eve Bohnett[2]

[1]Southeastern Grasslands Institute, Clarksville, TN, [2]University of Florida, Center for Landscape Conservation Planning, Gainesville, FL

Among the prominent ecological myths about Florida is that, due to its modest topography, it has high climate velocity and lacks climatic resilience. A related myth is that its low elevation profile has led to inundation by the sea during warm periods such as Pleistocene interglacial stages, which would have eliminated terrestrial and freshwater biota. These myths are difficult to reconcile with Florida's exceptional biodiversity, which includes many paleoendemic as well as neoendemic taxa, with total endemism rates higher than any U.S. state besides California. Here we show that Florida has had, and should continue to have to some degree, a high level of climatic resilience due to the presence of climatic refugia at several spatial scales. First, as the biologically richest spot in a global biodiversity hotspot, Florida follows the pattern of other global hotspots in being a long-term regional climatic refugium with multiple concentrations of endemic taxa. At a subregional scale within the state boundaries, Florida has several areas with relatively low levels of recent change in temperature or precipitation. Finally, at a finer spatial scale, Florida's karst topography and abundance of caves, springs, sinkholes, lakes, and wetlands provide numerous climatic microrefugia. Critical sea-level rise escape corridors also still exist along Florida's extensive coastline. Along with providing coast-inland and south-north habitat connectivity, protecting multi-scale climatic refugia and areas of high habitat heterogeneity is a conservation priority in Florida.

158 - A Right of Passage: Refugial Corridors and Wildlife Crossings in the Appalachians

Lauren Lyon

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The Appalachian ecoregion encompasses the greatest mammalian diversity in the eastern Nearctic, having served as a key biodiversity hotspot and travel corridor since the Pleistocene. Today, the Appalachians serve as climate change refugia from increasing global temperatures, particularly in comparison to the surrounding southeastern landscape, and encompass large contiguous areas of protected land. Presence of these relict Pleistocene systems, such as Appalachian boreal forests, and traditionally northern taxa at high elevation are additionally susceptible to climate fragmentation, which compounded with anthropogenic disturbance and climate change would result in the loss of these unique systems. In our study, we focused on the climate change refugia of a charismatic flagship mammalian species iconic of the Appalachians, the American Black Bear, in comparison with the more cryptic but ecologically important rodents and their respective climate change refugia. We identified presence of climate change refugia for all 28 species of rodents that occur in the Appalachians, calculated feasibility of corridor connectivity between these refugial patches based on dispersal ability, and finally identified major anthropogenic barriers, namely large interstates, that impede habitat connectivity. We then overlaid these findings with that of the bears, given recent media attention and funding towards wildlife corridors, particularly outside of the Great Smoky Mountains National Park on Interstate-40. In doing so, we have shown key areas where a flagship species can benefit lesser loved, more cryptic, but ecologically important taxa that would otherwise become isolated in refugial hotspots within the Appalachians, while highlighting areas of mismatch where placement of an overpass/underpass based on the needs of the bear alone would likely omit key areas for the bulk of mammalian diversity in the Appalachians.

SYMPOSIUM: Conservation of Southern Appalachian Salamanders

Thomas Wilson, University of Tennessee at Chattanooga, Chattanooga, TN

Introduction

172 - Recovering Tennessee Hellbenders

Michael Freake[1], Bill Sutton[2], Rebecca Hardman[3], Brad Nissen[4], Emilly Nolan[5], Marley Machara[2]

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Eastern hellbenders Cryptobranchus alleganiensis are listed as endangered in Tennessee. This listing decision was based on extensive rock lifting and environmental DNA surveys, which indicated that hellbenders have disappeared from much of their range. In middle Tennessee most extant populations comprise of older individuals with little evidence of successful consistent recruitment. Populations in East Tennessee, especially on public lands, do show evidence of successful recruitment, however these populations are often small and isolated by impoundments, and historic land use practices appear to have extirpated many populations. Our goal is to stabilize middle Tennessee populations using adult individuals raised from wild collected eggs, head started at Nashville Zoo. In east Tennessee our goal is to establish new populations in rivers on public lands with suitable habitats by translocating adults from stable recruiting populations, or head starting wild collected eggs for release as 2-3 year old sub-adults. These captive bred releases and wild translocations has had mixed success with predation, habitat limitations, and disease all creating challenges. However modifications to husbandry and release protocols have increased success to ~60% survival in middle Tennessee. Survival rates of translocated wild adults in East Tennessee were 100% at one release site, but only 33% at another, mostly likely attributable to otter predation. Our next priority in East Tennessee is to identify suitable habitat for sub-adult releases in streams with suitable habitat and low predation risk

173 - Sexual dimorphic effects of a keystone predator on prey communities

Jon Davenport, Alan Babineau, Reese Sloan, Autumn Groesbeck, Ali Montazeri

Appalachian State University, Boone, NC

The importance of trait variation has long been recognized in ecological and evolutionary research. One form of intraspecific trait variation, sexual dimorphism, has potential ecological effects between trophic levels in food webs. The divergence of sexually dimorphic traits (e.g., body size, morphology, behavior, etc.) is primarily attributed to sexual selection but variability can have consequences for diets and habitat use. Recent evidence for one aquatic predator species (adult newts; *Notophthalmus viridescens*) suggests that trait differences and habitat partitioning between the sexes may be important in structuring zooplankton communities. However, adult male newts are known to increase amphibian diversity within pond communities via keystone predation. Yet, no data is available on adult female newts on larval amphibian communities. Thus, we conducted mesocosm experiments in 2021 (with spotted salamander larvae) and 2022 (with wood frog tadpoles) to determine the effects of sexual dimorphism of adult newts on larval amphibian communities. We hypothesized that male and female newts would have differing effects on prey communities. We found that female newts significantly consumed more amphibian prey than male newts and no newt treatments. Size at metamorphosis was greater in the presence of newts (either male or female) in comparison to no newt treatments. Our findings indicate that sexual dimorphism within a known keystone predator can have differential effects on prey. Indeed, our results indicate that while the effects of predators on one response (survival) can differ within sexes, the ultimate impacts on another response (prey fitness; measured as size at metamorphosis) are the same. It has never been more important than ever to understand the effects of sexual dimorphism as sex ratios of predators may become skewed in nature with some sexes are more at-risk. If intraspecific differences exist via top-down effects, then downstream impacts on prey communities may go unnoticed.

174 - Known Knowns, Known Unknowns, and Unknown Unknowns: Macroparasites and their Possible Threat to Appalachian Salamanders

Carlos Camp

Piedmont University, Demorest, GA

Emerging, infectious diseases such as chytridiomycosis and ranaviral disease have been responsible for the decline and extinction of amphibian populations worldwide. Naturally, these diseases are a major focus in efforts to conserve salamanders of the southern Appalachian Mountains. However, the impacts of macroparasites including helminths, leeches, and arthropods have on these salamanders are not well known. Moreover, the possibly enhanced vulnerability to infectious-disease infections because of overloading salamander immune systems with multiple infections has been largely ignored. Even baseline information on the content and extent of resident parasite communities is lacking for many species that are vulnerable due to having small geographic ranges or existing in low population densities. One reason for the lack of basic information on the internal parasites of rare species has been the historic dependence on dissection to identify endoparasites. However, noninvasive, PCR-based methods have recently been developed to detect and quantify endoparasitic infections from salamander fecal material. Unfortunately, the pathogenic effects of macroparasites—much less the

consequences of co-infections by macroparasites and agents of infectious disease—are poorly understood even for common amphibian species. The absence of data not only demonstrates a critical gap in our knowledge of the potential impacts of disease on Appalachian salamanders but also presents rich opportunities for meaningful research.

175 - Lessons from ten years of research on mountaintop removal mining and stream salamanders

Steven Price

University of Kentucky, Lexington, KY

Across central Appalachia, land-use changes arising from mountaintop removal coal mining and valley filling (MTR-VF) represent a pervasive influence on wildlife populations and their habitats. Stream salamanders (Family Plethodontidae) reach exceptionally high population densities and drive numerous ecosystem processes in Appalachian low-order streams. From 2013-2016, we documented reductions in salamander occupancy, abundance and species richness in streams impacted by MTR-VF relative to reference locations. Recently, our research has focused on mechanisms responsible for population declines. Specifically, we explored two hypotheses responsible for salamander population declines in MTR landscapes: (1) changes to land-use reduce colonization and persistence rates within MTR streams and (2) changes to water chemistry in MTR streams affect salamander abundance and diets. To test our first hypothesis, we conducted repeat count surveys over three consecutive years in MTR and reference (i.e., forested) landscapes in southeastern Kentucky. We found that most species and life stages exhibited reduced colonization and persistence rates. Across the entire salamander assemblage, the mean colonization and persistence rates in MTR landscapes were 0.17 (95% CI = 0.06-0.37) and 0.70 (95% CI = 0.45-0.92) respectively, whereas the colonization and persistence rates in reference landscapes were 0.82 (95% CI = 0.44-0.97) and 0.95 (95% CI = 0.81-0.98). To test our second hypothesis, we examined salamander abundance and diet composition across a specific conductivity (SC) gradient. As SC increased, salamander abundance declined consistently across species and life stages. Diet composition was also correlated with SC; for example, aquatic prey consumed, total prey volume, and body condition decreased as SC increased. Although these studies indicate mechanisms responsible for population declines are multifaceted, the similarity in species' responses to MTR suggests that land-use management may benefit the entire assemblage. For example, reforestation and soil reconstruction could restore habitat conditions in both terrestrial and stream environments required by salamanders.

176 - What determines the downstream range limits of stream salamanders?

Kristen Cecala

University of the South, Sewanee, TN

Stream salamanders dominate headwater stream communities as the primary top predators. Their distribution is restricted to ephemeral and perennial low-order streams. The mechanism maintaining this upstream distribution has been associated with upstream-biased movement, predator avoidance, susceptibility to high flow velocities, and even low detection in deeper water, but few studies have examined the strength of evidence for these hypotheses. We used ex-situ mesocosms to explore the performance and habitat selection responses of salamanders to headwater fish. Both larval and adult life stages perform poorly in the presence of fish despite fish being caged to prevent physical interactions. Furthermore, when provided with land to escape the presence of fish, adult salamanders select for terrestrial habitat more often, and poor performance in the presence of fish is maintained even when terrestrial prey is available. Avoidance of aquatic habitat in the presence of fish may reduce the resilience of downstream populations to additional stressors including forest conversion and climate change further isolating headwater salamander populations.

177 - Green Salamanders (Aneides aeneus) alter rock crevice use in the face of anthropogenic disturbance

Walter Smith, Garrett Stiltner, Hunter Hill

The University of Virginia's College at Wise, Wise, VA

Green Salamanders (*Aneides aeneus*) are rock outcrop specialists that require cracks and crevices in vertical rock substrate as habitat. Green Salamander declines have been associated with habitat disturbance, and recent work has shown that woody vegetation removal adjacent to rock outcrops significantly warms and dries available crevices. However, no empirical data currently exist confirming that altered microclimatic profiles in rock crevices influence Green Salamanders' habitat use. We performed a season-long comparison of Green Salamanders' selection of crevices with particular microclimatic attributes (temperature, relative humidity) at a site impacted by woody vegetation removal in Norton, Virginia, comparing patterns at this location with a nearby site not experiencing anthropogenic disturbance. Crevices occupied by Green Salamanders at the impacted site consistently presented as microclimatic outliers when compared against a random sampling of unoccupied crevices at the same site, with occupied crevices being significantly cooler and more humid than background crevice conditions. By contrast, occupied crevices at the reference site did not present as outliers, nesting within the broader microclimatic profiles of available crevices at this site. These patterns were consistent throughout the species' active season, indicating that salamanders are constrained to a limited number of crevices with particular microclimatic attributes at sites experiencing impacts from habitat disturbance. Our results confirm that vegetation removal adjacent to rock outcrops alters habitat availability for Green Salamanders and serves as a potential mechanism explaining salamander declines at impacted sites. Our results also have broader implications for our understanding of Green Salamander abundance at rock outcrops with variable microclimatic attributes, as well as for the design of management approaches for this species.

178 - Developing a Predictive Geospatial Habitat Model for a Rare Species of Salamander in Tennessee: A Case Study for the Green Salamander (Aneides Aeneus)

Erin Lienhard, Thomas Wilson, Nyssa Hunt, Hong Qin

University of Tennessee at Chattanooga, Chattanooga, TN

Green Salamanders (*Aneides aeneus*; Cope and Packard 1881) are a secretive and cryptic species of salamander that can be relatively difficult to detect, due to their occupation of arboreal habitats. The incorporation of geospatial tools is critical in developing models that can be used to predict undocumented locations in Tennessee and elsewhere. Locating the species in Tennessee was accomplished through a total of 18 localities and with that, several habitat characteristics were able to be identified including, but not limited to: appropriately shaded and structured rocks, typical fauna co-occurring within the area, and general topography of the area. Of the 91.8% of sites that were deemed to have suitable habitat, 40% of those had positive presence, the remaining 60% is indeterminate for presence at this time as more field visits should be conducted in the future.

Discussion

SYMPOSIUM: Women in Biology Inspired by Women in Biology (Organized by UTC WINS)

Jennifer Boyd, University of Tennessee at Chattanooga, Chattanooga, TN and Lorance Bradford, University of Tennessee at Chattanooga, Chattanooga, TN

Introduction by Dr. Jennifer Boyd

159 - Exploring eco-evolutionary causes and consequences of plant species rarity

Jennifer Boyd

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It has long been observed by ecologists and natural historians that species differ drastically in their prevalence in the natural world. But the biological factors that influence such differences are not well understood. While more than one-third of land plant species are considered to be rare or very rare, elucidating the factors that influence rarity can be complicated by the multi-dimensionality of rarity as defined by species' geographic distribution, local abundance, and habitat specialization as classically described by the late plant ecologist Deborah Rabinowitz. To examine potential eco-evolutionary causes and consequences of rarity, we conducted a series of comprehensive phylogenetically controlled meta-analyses of comparative congeneric studies of rare and common plant species from the past four decades. Overall, we found that rare species have reduced population genetic diversity, depressed fitness, and smaller reproductive structures than common congeners and that rare species also could suffer from inbreeding depression and reduced fertilization efficiency. We present these results and our recommendations for future avenues of research within the context of both various manifestations of rarity and contemporary environmental change.

160 - Rotifers show us that males are not necessary, except when they are

Francesca Leasi

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Rotifers are excellent models for exploring sex in an evolutionary and ecological context. The phylum Rotifera has three distinct life cycles, each corresponding to a major clade within the phylum. Seisonids strictly engage in sexual reproduction. Bdelloids only reproduce asexually, and they have been extensively studied to show the ancient nature of their asexuality. Most research has focused on the genetic mechanisms behind their evolutionary success without sexual reproduction. Monogononts display a facultative combination of sexual and asexual reproduction. In monogononts, asexual reproduction prevails, with intricate mechanisms governing the transition to sexual reproduction. This transition is often orchestrated through the release of a chemical signal by females into the surrounding environment. Other mechanisms involve diet and specific photoperiods. Here, I will discuss recent advancements in rotifer reproduction research, predominantly employing genomic and ecological approaches, emphasizing the exploration of evolutionary causes and consequences of sex. My fascination with rotifers was ignited by the late Dr. Claudia Ricci, my first postdoc advisor and a true expert in bdelloid rotifers.

161 - Breadth First Search Algorithm to Identify Connected Reserve Systems

Lakmali Weerasena[1], Douglas Shier[2], Mark McFeaters[1], Christopher Collins[1], David Tonkyn[2]

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Ensuring connectivity among protected areas is vital for effective conservation, especially in the context of climate change and international conservation mandates. This study introduces a novel breadth-first search algorithm designed to efficiently identify connected reserve systems. Connectivity solutions vary based on species mobility, from stepping stones for migratory species to continuous corridors for those less mobile. Our algorithm focuses on optimizing corridor placement within existing reserve networks, considering corridors as either transit routes or habitats for resident species. Utilizing optimization techniques, the algorithm is inspired by notable contributions in corridor identification. Unlike existing methods, such as individual-based models or graph theory, our breadth-first search algorithm offers a distinctive and efficient approach to enhancing reserve connectivity. Corridor identification plays a crucial role in conservation planning, contributing to the design of effective reserve networks.

The algorithm presented in this study complements existing methodologies, providing a valuable tool for conservation practitioners and researchers working towards establishing well-connected reserve systems. Its efficiency stems from a strategic integration of breadth-first search principles tailored to the unique challenges of reserve connectivity. In summary, this study addresses a critical aspect of conservation planning by introducing a novel algorithm for identifying connected reserve systems. By optimizing corridor placement within existing networks, the algorithm contributes to the creation of effective and resilient reserve systems, aligning with global conservation goals.

162 - Actualistic taphonomy experiments as analogs for microbial ecosystems of early Earth

Ashley Manning-Berg

University of Tennessee at Chattanooga; Biology, Geology, and Environmental Science Department, Chattanooga, TN

Exceptionally preserved fossils can inform our interpretations of life on early Earth and potentially habitable extraterrestrial environments. Silica deposits in carbonate strata of Proterozoic Era tidal environments commonly preserve such exceptional microbial fossils. The process of silicification is not well understood in these environments and changes in the Earth's silica cycle mean that there are no modern analogs for these environments. In such cases, actualistic experiments can provide insight into the fossilization process in these deposits. With their expansion on the definition of taphonomy, Anna Behrensmeyer and Susan Kidwell emphasized that information can be gained from taphonomy and used to infer conditions in paleoenvironments and ecosystems.

Results of actualistic taphonomic experiments designed using extant microorganisms as analogs for those seen in silica deposits are presented here. These experiments build on those performed by Julie Bartley (1996) and identify diagenetic pathways for microorganisms analogous to those preserved in Proterozoic strata. Previous experiments have documented morphological changes resulting from biological decomposition of filamentous and coccoidal microbes; however, these experiments used monocultures. The research presented here uses microbial consortia to explore patterns of biological decomposition and its effects on mat textures and individual morphologies. Decomposition pathways for each microbial mixture closely resemble the modeled and observed pathways for monocultures in Manning-Berg, Selly, and Bartley (2021).

163 - Women Shaping Urban Ecology through Research and Mentorship

DeAnna Beasley

University of Tennessee at Chattanooga, Chattanooga, TN

Urban ecology, a multidisciplinary field addressing the complex interactions between human and natural systems in urban environments, is strongly influenced by women researchers and mentors. In this presentation, I will explore the role of key women researchers in shaping how we view the urban ecosystem and future directions in the research. I will also discuss the important role of women in mentoring and preparing future generations of researchers while fostering an inclusive and collaborative research culture. I'll use the NSF-REU Collaborative Site: The Socio-Ecological Role of Greenways in Urban Systems (SERGUS) REU program as an example of how women are creating interdisciplinary collaborations to better understand the social and ecological characteristics of urban greenways across multiple cities.

164 - Understanding regulatory mechanisms of eukaryotic gene expression by Ubiquitin-proteasome system (UPS)

Jannatul Ferdoush

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In choosing my research agenda during my doctoral study I was inspired by several women scientists in the field. Specially, inspired by the seminal works of Nobel laureate Emmanuelle Charpentier and Jennifer Doudna, I have chosen 'regulation of eukaryotic gene expression' as my research topic in doctoral study. Their ground-breaking research helped develop CRISPR-Cas9 gene-editing tools used for gene modification to cure cancer. I was also heavily motivated by Rosalind Franklin whose work helped discover the structure of DNA. Especially her death from the excessive exposure to X-ray moved me significantly to choose a career to serve humanity. Another Nobel laureate Carolyn Bertozzi is also a great inspiration for me. Infact, following her footsteps, I now work on modification of proteins by Ubiquitin-proteasome system (UPS), which plays important role in regulation of eukaryotic gene expression, which is a highly synchronized cellular process comprised of transcription. Regulation of transcription is crucial for normal cellular function, since dysregulation of it is associated with various diseases including cancer. Many proteins/ transcription factors (TFs) are associated with transcription, which are regulated by diverse regulatory processes such as UPS, to maintain normal cellular function. The evolutionary conserved UPS (Polyubiquitin and 26S proteasome) involves in degradation of TFs, and thus, regulates transcription. However, mechanisms of the UPS regulation of transcription are not clearly understood. Therefore, we aimed to understand the regulatory mechanisms of transcription by UPS, using yeast (*Saccharomyces cerevisiae*) as a model eukaryote. We found that TF PAF1 is regulated by UPS. We also found that TFs TAF2, TAF13 undergo polyubiquitylation and have yet to find if these are regulated by 26S proteasome. Since these TFs are overexpressed in many cancers, understanding the regulatory mechanisms of UPS regulation of these TFs in regulating transcription, would have significant impact on disease pathogenesis with future therapeutic development.

165 - Using mathematical modeling to understand biodiversity in animal behavior

Hope Klug

University of Tennessee at Chattanooga, Chattanooga, TN

Mating and parental behavior are key components of fitness. In animals, we see incredible diversity in both mating and parental behavior. For example, some animals compete intensely for mates, whereas mate competition is seemingly absent in many species; similarly, some species provide elaborate parental care, while other species lack any form of post-oviposition or post-birth parental investment. Understanding such diversity in mating and parental behavior has been a major focus in studies of evolutionary ecology. In this presentation, I will highlight how mathematical models can be used to provide insight into the evolution of mating and parental behavior. I will discuss recent research from my lab that illustrates that resource competition and life history can influence the evolutionary dynamics of mating and parental behavior. I will also discuss how the mathematical modeling work of women has inspired my own research program and impacted the field of evolutionary ecology in general.

Discussion

SYMPOSIUM: Memoirs in Aquatic Biology: A Tribute to Dr. Mark Schorr—Teacher, Mentor, and Scientist

Thomas Wilson, University of Tennessee at Chattanooga, Chattanooga, TN

Introduction

179 - A GIS for the Urban Stream Projects of Chattanooga, TN

AKM Azad Hossain

The University of Tennessee at Chattanooga, Chattanooga, TN

The City of Chattanooga, TN, has grown substantially during the last several decades and has become the center of a series of urbanized sub-watersheds. The environmental impacts, especially the quality of surface waters due to this growth, have become a major concern for the sustainable developments of the greater Chattanooga areas. The data and research results obtained from the urban stream projects conducted at the University of Tennessee at Chattanooga during 1998-99 and 2020-22 have become a great resource to study the impacts of land use land cover change on the surface water quality in the watersheds of Southeast Tennessee. However, it will not be possible to realize the full potential of this enormous resource until the data and research results from both projects are combined and put in a GIS. This project aims to fill this gap as a follow-on work of the current urban stream project at the University of Tennessee at Chattanooga. Project design and the obtained preliminary results will be presented and discussed.

180 - A Literature and Survey Assessment of Using Wildlife Detector Dogs in Turtle Conservation

Hunter Smith, Thomas Wilson

University of Tennessee at Chattanooga, Chattanooga, TN

The use of Wildlife Detector Dogs in turtle conservation is underutilized. While some studies have shown usefulness in the dog's ability to consistently find turtles, concerns of expense and feasibility often override the possibility of employing a professional wildlife detector dog. This project examines the feasibility of training and implementation of Wildlife detector dogs by assessing the primary and secondary literature and surveys conducted with professional dog trainers around the world. Professional dog trainer surveys will be analyzed for the best and most common practices amongst the top trainers and compared to literature results. Statistics on specific breeds including bite data, temperament tests and general breed traits, will also be considered. The consolidation of the materials that show most promise will be put into a training manual to be utilized by any organization hoping to use dogs in wildlife detection and turtle conservation.

181 - Unveiling the Hidden World: Freshwater Meiofauna Biodiversity in the Southeastern United States

Francesca Leasi

University of Tennessee at Chattanooga, Chattanooga, TN

The Southeastern United States is celebrated for its abundant freshwater biodiversity, yet meiofauna, encompassing small-sized (< 2mm) invertebrates, continues to be widely overlooked. These microscopic organisms play vital roles in aquatic ecosystems, contributing to functions such as nutrient cycling and sediment stability. Despite their ecological significance, their diversity and response to disturbances have received insufficient exploration, constraining our understanding and capacity to address the repercussions of pollution and environmental changes. In this presentation, I share the outcomes of my research at UTC, focusing on meiofaunal biodiversity in freshwater ecosystems surrounding the Chattanooga area. Utilizing a diverse array of methods that encompass morphological and molecular tools, my objective is to enlighten this neglected facet of biodiversity. Moreover, my initiatives extend to and integrate well with the educational realm, where the survey class "Meiofauna Biodiversity" empowers students to cultivate their research projects and observe meiofauna in their local surroundings. Over the span of four years, my research has uncovered a notable enhancement in freshwater meiofauna biodiversity, indicating that the Southeastern US is a hotspot for these neglected organisms. This undertaking, uniting research and education, is inspired by the legacy of the late Dr. Schorr. My brief involvement in Dr. Schorr's limnology class, coupled with the opportunity to observe him as a colleague, researcher, and educator, allowed me to witness his unwavering passion and dedication to students and freshwater studies. This experience has profoundly influenced the trajectory of my research and educational pursuits.

182 - Swimming Through the Memories: A Series of Short Stories

Amelia K Atwell

Wofford College, Spartanburg, SC

Dr. Mark Schorr was an incredibly influential person on my life. I first met him in graduate school while a student at University of Tennessee at Chattanooga where he became my advisor, teacher, and ultimately my mentor. Dr. Schorr exposed me to the world of stream ecology and helped me to find my passion in the sciences and played a role in my ultimate decision to go into academia. My presentation will be a series of short stories about my relationship with Dr. Schorr. This will range from the history between how he came to be my advisor at UTC, my experiences within his classes as a student, what it was like to be a teaching assistant for him, my first academic conference experience, and our relationship after graduating. I am incredibly grateful to have worked with Dr. Mark Schorr and have the opportunity to have a relationship beyond my time in graduate school at UTC.

ASB Workshops

WORKSHOP: The Only Constant is Change: Programmatic Workflows to Access, Prepare, and Work with NEON Data

Laura Nagel, National Ecological Observatory Network, Battelle, Tuscaloosa, AL and Margaret Cumberland, National Ecological Observatory Network (NEON), Oak Ridge, TN

WORKSHOP: Honey I Blew Up the Molecules: 3D Printing as a Multi-faceted and Multi-disciplinary Pedagogical Practice

Carmony Hartwig, Zachary Trivett and Andrew Jacobson, Catawba College, Salisbury, NC

WORKSHOP: Stories from the Field: Best practices for Field Experiences

Steph Jeffries, NC State University, Raleigh, NC

WORKSHOP: After Graduation: Delving into post-baccalaureate options and graduate school applications

Jeremy Rentsch[1], Jennifer Mandel[2] and Shoshana Katzman[3], [1]Francis Marion University, Florence, SC[2]University of Memphis, Department of Biological Sciences, Memphis, TN[3]Agnes Scott College, Decatur, GA

WORKSHOP: Our redesigned and revamped *Eastern Biologist* journal–*eBio*

Veronica Segarra, Goucher College, Baltimore, MD

WORKSHOP: Social Field Safety : Being more inclusive and understanding risks for marginalized and historically excluded individuals who professionally work outdoors

Lauren Pharr[1], Kayla Stukes[2] and Murry Burgess[3], [1]Wingate University, Wingate, NC[2]North Carolina State University, Raleigh, NC[3]Mississippi State University, Starkville, MS

WORKSHOP: Fulbright Opportunities for Biologists

Mac Alford[1], Lytton John Musselman[2] and Jay Bolin[3], [1]The University of Southern Mississippi, Hattiesburg, MS[2]Old Dominion University, Norfolk, VA[3]Catawba College, Salisbury, NC

ASB Presentations

1 - An Alternative to Western Blotting: Using In-Gel fluorescence to Study the Autophagy Pathway and Keratin Biomaterials in Human Embryonic Kidney 293 Cells

Melissa Rogers, Bryan Gutman, Robert Youker, Heather Coan

Western Carolina University, Cullowhee, NC

Autophagy is a highly conserved catabolic process essential for the maintenance of cellular homeostasis. In order to study autophagy in cell cultures, researchers track the expression and modification of the autophagy marker protein LC3 as it changes from LC3-I to LC3-II. Common techniques to visualize this change include western blotting and dual reporter fluorescent imaging. However, these techniques suffer due to their time-consuming nature, complexity, and proclivity to subjective interpretation. Thus, the field of autophagy research needs an alternative method for assessing autophagy. To meet this need, we developed an in-gel fluorescence technique to analyze autophagy in Human Embryonic Kidney 293 cells and compared its usability to western blotting and dual-reporter fluorescent imaging. We compared in-gel fluorescence to western blotting and dual reporter fluorescent imaging using autophagy controls rapamycin, chloroquine, and 3-MA and discussed the advantages of using this method. We then used in-gel fluorescence to assess a biomaterial of interest to our lab. Previous experiments in our lab suggest a relationship between keratin biomaterials and cell recycling pathways such as the autophagy pathway. We use our in-gel fluorescence method to investigate the relationship between keratin and autophagic activity in Human Embryonic Kidney 293 cells dosed with crude keratin extract and autophagy controls.

2 - Using Force Sensitive Domains to Produce Synthetic Receptors in Drosophila

Breana Walton, Simran Bhikot, Paul Langridge

Augusta University, Augusta, GA

The Notch signaling pathway plays an important role in several physiological and developmental processes. Notch is activated when force arising from endocytosis of the signaling cell ligand exposes the Notch protein to a protease. Proteolysis of Notch initiates irreversible activation of the receptor and the release of the cytosolic domain to the nucleus where it acts as a transcription factor. Due to the simple mechanism of activation, Notch can be engineered to create different combinations of ligands and receptors that produce customizable responses. Such man-made or synthetic receptors have potential use in therapeutics, particularly in regenerative medicine and tissue engineering where they could alter the form and function of replacement tissues. However, little is known about how these receptors operate in vivo, particularly in epithelial cells where they could one day be applied. Using Drosophila melanogaster, our goal is to build and test new versions of the Notch receptor and to determine whether they are suitable for use in future therapeutics. Here we focus on identifying which structural changes to the receptor alter its properties and whether the receptors can be used to produce a response at a precise time and location in the complex tissue of the wing imaginal disc.

3 - Design and Application of pDA Treatment Method for Polylactide Fibers to Enhance Cell Separation of MCF-7 Cells

Emily Evans[1], Courtney Long[2], Weitong Chen[3], Timothy Burg[4], Karen JL Burg[3]

[1]Wesleyan College, Macon, GA, [2]University of Georgia: School of Chemical, Materials and Biomedical Engineering, Athens, GA, [3]University of Georgia Department of Small Animal Medicine & Surgery, Athens, GA, [4]University of Georgia Department of Biomedical Sciences, Athens, GA

Current methods of cancer diagnosis in dogs such as fine needle aspiration, liquid biopsy, and ultrasonography, may be inconclusive, expensive, and occur when the cancer is already at an untreatable stage. Previous work in the Harbor Lights Laboratory at the University of Georgia College of Veterinary Medicine focused on developing a novel, rapid, assessment tool that focuses on separating and detecting cancer cells from a heterogeneous population. The device employs the wicking capacity of lobed fibers to separate cells based on physiological characteristics such as cell size. In the present study, zones of polylactide (PL) fiber bundles were made hydrophilic to optimize the wicking of human breast cancer cell (MCF7) populations. This was accomplished by designing and building an apparatus that treated the fibers at ⅔, ¾, and complete lengths. Differences between average treatment lengths were assessed by paired t-test analysis and differences in the treatment duration and cell count were assessed by one-way ANOVA. The fiber treatment apparatus design used in this experiment successfully treats fibers in full and at varying fractional lengths, suggesting it is a robust method for future experiments. Results were inconclusive when attempting to determine if partially treated fibers (⅔ or ¾) increase the population of tumor cells after 20 minutes of wicking; therefore, more repetitions should be conducted. Future investigations of efficient alginate cap collection and fiber treatments are ongoing to improve the process of wicking fiber-based cancer assessment tools in general veterinary medicine.

4 - Exploring Caspofungin Unmasking in Candida auris to Enhance Macrophage-Mediated Antifungal Immunity

Bradley Akin, Logan Baker, Oscar Arellano, Sahar Hasim

Mercer University, Macon, GA

A major challenge in detecting *Candida auris*, a multi-drug-resistant fungal pathogen in the human body, is its ability to evade the immune system through a cell wall-masking mechanism. Caspofungin is an antifungal agent that disrupts the synthesis of ß (1-3)-glucan, a critical cell wall component that interacts with macrophages to identify and eliminate these pathogens. In this study, we used sublethal caspofungin levels to disrupt this masking, exposing beta-1,3-glucan to the dectin-1 receptor found on macrophages. After a

3-hour incubation with caspofungin, we added anti-beta-1,3-glucan antibodies to evaluate the presence of beta-1,3-glucan in the cell wall. Next, each unmasked strain is incubated with macrophages, and lactate dehydrogenase concentrations are measured using the CytoTox 96® Non-Radioactive Cytotoxicity Assay kit. Additionally, we quantify the number of *C. auris* destroyed by macrophages using a macrophage-killing assay. Preliminary data from our study indicate that macrophages exhibit enhanced phagocytic activity against unmasked *C. auris* strains following caspofungin treatment. These findings suggest that targeting the mannan layer to expose beta-1,3-glucan may represent a promising strategy for enhancing the host immune response against *C. auris*, potentially opening up new avenues for therapeutic interventions in combatting this drug-resistant fungal pathogen.

5 - Cell Proliferation Response to miRNA 342-3- expression in Triple Negative Breast Cancer

Haley Roberts

Mary Baldwin University, Staunton, VA

Triple Negative Breast Cancer is a very invasive, very aggressive type of breast cancer that is difficult to treat. TNB cells do not express the estrogen receptor, the progesterone receptor, and has very little expression of the human epidermal growth receptor, HER2, which are common targets of breast cancer therapies. This cancer can become metastatic very quickly, so the only treatment options that help to prolong the patient's life is a lumpectomy, or a mastectomy, which give very low survival rates, with high levels of reoccurrence. miRNA 342-3p is a type of miRNA that suppress the proliferation of human breast cancer cells, as it targets the Cofflin 1 protein. miRNA 342-3p has been tested on lymphoma, and has had positive outcomes with slowing down the proliferation rate of those lymphoma cells. miRNA 342-3p however, has not been tested on TNBC. This experiment will test the effect of exogeneous overexpression of miRNA 342-3p on the proliferation of TNBC cell line MDA-MB 231. After transfection with an expression plasmid containing miRNA 342-3p, the cells will be monitored and counted at specific time points to see if cell proliferation is reduced. In this study, we hope to see the cell proliferation decrease with the addition of miRNA. With the success of this experiment, it will give an insight into the value of using miRNA as potential therapeutics for Triple Negative Breast Cancer.

6 - Evidence for phosphate-dependent control of symbiont cell division in the model anemone *Exaiptasia diaphana*

Alexis Deloach, Daiven Sharma, Sebastian Sisk, Geoffrey Mitchell

Wofford College, Spartanburg, SC

Corals harbor endosymbiotic algae, which furnish them with over 90 percent of their energy requirements, ultimately rendering this association indispensable for the host's survival. The increase in ocean temperatures, driven by global warming, is jeopardizing the stability of this delicate symbiotic relationship. As a result, researchers have been trying to address the fundamental question of how coral hosts regulate the cell proliferation of their algal symbionts to uphold a healthy relationship. This study delves into the investigation of a potential phosphate-limiting mechanism exerted by the coral host on its symbiotic algae, proposed to play a pivotal role in maintaining balance within the coral-algae symbiotic relationship. Total phosphorus, inorganic phosphorus, and organic phosphorus were isolated from symbiotic algae within the anemone *Exaiptasia diaphana*, a coral model organism, under three distinct conditions: phosphorus-deplete, phosphorus-replete, and freshly isolated. Our findings revealed that algae freshly isolated from their hosts exhibited significantly lower concentrations of total phosphorus, inorganic phosphorus, and organic phosphorus compared to the phosphorus-deplete and phosphorus-replete conditions. These outcomes suggest the implementation of a phosphorus-limiting control mechanism by the *Exaiptasia*, aiming to regulate phosphorus availability to its algal symbionts. The implications extend to the broader coral-algae relationship, as corals must similarly employ mechanisms to restrict phosphorus flow to their algal symbionts, thereby mitigating hyperproliferation and sustaining equilibrium within the symbiotic association. It is plausible that additional control mechanisms contribute to this equilibrium, necessitating further research for a comprehensive understanding of these delicate interactions.

7 - Determining the relative consistency of ZP proteins in the IPVL of oviposited chicken eggs

Reece Wyatt, Drew Benson

University of Georgia, Athens, GA

The standard assay for assessing hen fertility is the sperm-penetration assay, which counts the number of sperm hole penetrations around the germinal disc (GD) region of the inner perivitelline layer (IPVL). Following ovulation, the IPVL is the sole protein barrier that sperm must penetrate for successful fertilization. The IPVL consists of zona pellucida (ZP) proteins. Poultry-specific antibodies for the three different ZP proteins, ZPB1, ZPC, and ZPB2, previously reported to be linked to poultry fertility were created. These antibodies have allowed for quantitative Western analyses to reveal ZP protein differences between genetic lines of turkey hens that differ in fertility and differences in the IPVL overlying the important GD region in both chicken and turkey. These results indicate ZP protein abundance is not static and that differences in ZP protein abundance at the GD region of the IPVL can be reflective of improved hen fertility. Although differences exist between genetic lines, no research has looked to determine if the relative abundance of different ZP proteins around the GD region and a non-germinal disc region remain consistent within an individual. 12 eggs from a single hen were collected over a period of two weeks and kept at 4°C until the IPVL could be isolated and sonicated. Following protein quantification, the GD and NGD regions of the IPVL were compared for relative expression of ZPB1, ZPB2, and ZPC. Like previous results, the relative abundance of ZP2 was greater in the GD region while both ZPB1 and ZPC were greater in the NGD region. Importantly, the relative concentrations of the three different proteins remained consistent for all eggs laid in the hen's clutch. These preliminary results indicate that the relative abundance of ZP proteins remains consistent with an individual and thus would be an ideal marker for genetic selection for improved hen fertility.

8 - Exploring Differential Expression of Zona Pellucida Proteins in the Germinal Disc Region of Flamingo Eggs: Does a conservation of relative protein abundance of ZP proteins around the GD exist is avian species?

Ashley Pitcher, Drew Benson

University of Georgia, Athens, GA

This study explores the differential expression of zona pellucida (ZP) proteins (ZPB1, ZPB2, ZPC) in the germinal disc (GD) and non-germinal disc (NGD) regions of the flamingo inner perivitelline layer (IPVL). Building on the known correlation between sperm hole penetrations at the GD and enhanced fertility in chickens, our aim was to assess IPVL composition consistency across avian species. Utilizing custom poultry-specific antibodies, we conducted quantitative Western analyses on flamingo IPVL, paralleling previous studies in turkeys and chickens. The ZP proteins of flamingos exhibited over 85% sequence identity with those of chickens, guiding our analysis. We isolated the IPVL from eight flamingo eggs provided by Zoo Atlanta, conducting sonication and protein quantification before performing Western blot analyses on ZPB1, ZPB2, and ZPC. Consistent with prior findings, ZPB2 showed a higher concentration in the GD region, with no significant differences in ZPB1 or ZPC between the GD and NGD regions. This pattern suggests ZPB2's pivotal role in sperm binding at the GD and hints at a potentially universal trend in avian species. Our findings illuminate aspects of the molecular mechanism underpinning avian fertilization and could inform strategies to tackle fertility issues in various avian species.

9 - Production of a novel mouse model with dysfunctional NF-κB signaling in bone marrow-derived macrophages

Jennifer Bradford

Department of Biological Sciences, Augusta University, Augusta, GA

Here, we describe the production and characterization of a novel mouse model which lacks canonical nuclear factor-kappaB (NF-κB) transcription factor RelA/p65 in bone marrow-derived macrophages. Macrophages are important phagocytic cells involved in the innate immune system and normally release pro-inflammatory cytokines and maintain homeostasis by eliminating pathogens and infected, damaged, or diseased cells. Bone marrow-derived macrophages from the $p65^{fl/fl}$/LysMCre model, which lack p65 protein, reveal NF-κB signaling deficiencies, a reduction in phagocytic ability, and reduced ability to produce nitrites. Despite abnormal bone marrow-derived macrophage function, $p65^{fl/fl}$/LysMCre mice do not exhibit differences in naïve systemic immune profiles or colony forming units and time to death following *Salmonella* infection as compared to controls. Additionally, $p65^{fl/fl}$/LysMCre mice, especially females, display splenomegaly, but no other obvious physical or behavioral differences as compared to control animals. As bone marrow-derived macrophages from this transgenic model are almost completely devoid of canonical nuclear factor-kappaB pathway member p65, this model has the potential for being very useful in investigating bone marrow-derived macrophage NF-kappaB signaling in diverse biological and biomedical studies.

11 - The conserved intronic element NCE functions as a developmental-stage specific enhancer that upregulates CD4 expression at the intermediate stage of thymocyte development and ensures error-free commitment to the T-helper lineage

Sophia Sarafova

Davidson College, DAVIDSON, NC

The regulation of Cd4 expression during T-cell development and immune responses is essential for proper lineage commitment and function in the periphery, however the mechanisms of genetic and epigenetic regulations are complex and not entirely understood. Previously, we have demonstrated the need for CD4 upregulation during positive select to ensure faithful commitment of MHC-II restricted T-cells to the CD4 lineage. In this study, we identify a Novel Cis-acting transcriptional control Element (NCE) and demonstrate it has a critical enhancer function during the intermediate (CD4+CD8lo, INT) stage of T-cell development in addition to a previously described epigenetic function. We show that NCE has developmental-stage specific enhancer function in vitro at the INT, but not the Double Positive (DP) stage of development by transient transfections of reporter plasmids in thymoma cell lines arrested at these stages of development. CRISPR/Cas9-mediated deletion of NCE in the same cell lines reveals a reduced expression rate of the Cd4 gene in NCE-deleted INT but not DP cells. We confirm these finding in vivo by generating BAC-transgenic reporter mice with the Cd4 locus modified to express EGFP in the presence or absence of NCE. In both the in vitro and in vivo systems, the absence of NCE results in lower levels of CD4 expression at the INT stage. In the mouse model the kinetics of the Cd4 reporter EGFP expression increases as thymocytes transition from DP to INT stage in NCE-sufficient mice, while NCE-deficient mice downregulate EGFP expression, consistent with NCE's developmental stage specific enhancer function. By using BAC transgenics instead of direct manipulation of the endogenous Cd4 locus, we diminish the epigenetic complications that have previously obscured the ability to evaluate this region as an enhancer and set the stage for further analysis of the complex process of Cd4 gene regulation.

12 - Thrombin's Impact on Motoneurons through the Rho-kinase Pathway

Biruja Dahal, Isabel Greco, Victoria Turgeon

Furman University, Greenville, SC

Thrombin influences a wide range of physiological processes by interacting with protease-activated receptor-1 (PAR-1), a G-protein coupled receptor found on many cell types. In motoneurons, PAR-1 impacts axon formation through activation of its downstream effector Rho-kinase. During development and following injury, Rho-kinase influences axon growth by regulating both actin polymerization and depolymerization. In vivo studies have shown that embryonic exposure to thrombin leads to the creation of morphological deformities in Caenorhabditis elegans motoneuron axons through Rho-kinase signaling. In C. elegans, motoneuron axons

innervate individual striated muscle cells and control their contraction to facilitate overall movement of that muscle, analogous to the neuromuscular junction in humans. If these observed morphological deformities are affecting the functionality of these axons, then movement impairments should be observed following embryonic exposure to thrombin. Furthermore, if Rho-kinase signaling is required for axon growth, then exposing C. elegans to a Rho-kinase inhibitor should also lead to these impairments. To assess motility, C. elegans were first exposed to one of four conditions: control, PAR-1 activation (100 µM thrombin), Rho-kinase inhibition (250 µM Y27632), and PAR-1 activation + Rho-kinase inhibition. The severity of their motility impairments were then assessed through a timed movement assay. A Kruskal-Wallis rank sum test and Wilcoxon post-hoc test (95% CI) showed a significant difference, with C. elegans co-treated with thrombin and the Rho-kinase inhibitor taking a significantly longer amount of time to complete the activity than any other group. These results indicate that PAR-1 activation and Rho-kinase inhibition alone have no impact on motility, suggesting that the observed morphologically deformed axons are still functional and the Rho-kinase pathway is not necessary for normal axon development. However, C. elegans may rely on Rho-kinase signaling following PAR-1 activation to sustain axon functionality.

13 - Regulation of G12/13 signaling by distinct post-translational mechanisms

Thomas Meigs

University Of North Carolina Asheville, Asheville, NC

The G12/13 subfamily of heterotrimeric G proteins serve as cytoplasmic conduits between specific cell-surface receptors and a variety of intracellular pathways, including those regulating cell proliferation, migration, and cytoskeletal rearrangements. The closely related α subunits of this subfamily - Gα12 and Gα13 in mammals - are well-documented as driving cancerous transformation either via mutational activation or overexpression. However, an area requiring more investigation is the post-translational regulation of these G proteins; only a small number of studies have examined the role of phosphorylation or lipidation in modulating their signaling function. We engineered a series of mutations in the N-terminal domains of Gα12 and Gα13, designed either to abrogate or mimic phosphorylation at specific amino acids. Our initial findings revealed a novel mechanism, specific to Gα12 but not Gα13, in which phosphorylation of a key serine appears to uncouple this protein from cell growth signaling despite no change in its intracellular levels. Surprisingly, a Gα13 chimera harboring only the N-terminal region of Gα12 was also subject to down-regulation by serine phosphorylation mimicry. Based on these results, we hypothesized a novel type of cross-regulation in which serine phosphorylation may disrupt the previously-reported enzymatic attachment of palmitic acid to a closely proximal cysteine side chain in Gα12. By engineering alternative lipidation sites within Gα12, we rescued growth signaling by its non-signaling mutants either lacking the palmitic acid attachment site (cysteine) or harboring the serine phosphorylation mimic. Our current efforts are to characterize this novel regulatory mechanism, including identification of the specific kinase and palmitoyltransferase enzymes that recognize and chemically modify the Gα12 N-terminus.

14 - Species Delimitation in the Loggerhead Kingbird (Tyrannus caudifasciatus) Species Complex

Alexander Worm, Emily Donahue, Than Boves, Andrew Sweet

Arkansas State University, Jonesboro, AR

As threats to global biodiversity increase, there is a heightened need to resolve disputed species lineages and uncover novel diversity through identifying cryptic species. The Loggerhead Kingbird (*Tyrannus caudifasciatus*) is currently considered a single songbird species comprised of seven subspecies distributed across multiple Caribbean islands within The Bahamas, Cayman Islands, Cuba, Hispaniola, Isle of Pines, Jamaica, and Puerto Rico. Previous work used plumage coloration, distribution, morphological data, and vocalization, to propose elevating the Hispaniola and Puerto Rico subspecies to monotypic species status. Despite conflicting taxonomic recommendations for the complex, no genomic work has been incorporated. Here, we used morphological and genomic data to delimit the Loggerhead Kingbird species complex as well as test the hypothesis that the Hispaniola and Puerto Rico subspecies should be monotypic species. We extracted genomic DNA from museum toe pad and tissue samples from each of the seven currently recognized subspecies and generated genome-wide SNP data. Using a variety of computational methods, we investigated the genetic clustering of samples to determine island population (sub)species status. In addition to our genomic data, we incorporated morphometric data from museum specimens from the Smithsonian Museum of Natural History to inform our delimitation of the complex. Using multiple lines of evidence, we determined that the species complex possessed cryptic species and propose an updated taxonomic recommendations for the species complex.

15 - YOU Can Help Cure Blood Cancers & Diseases

Matthew (Matt) Kroeger

NMDP (formerly Be The Match; effective 1/1/2024), Minneapolis, MN

Each year more than 12,000 people in the United States are diagnosed with a blood cancer (including leukemia and lymphoma) or blood disease (such as sickle cell disease). 70 percent of patients who need a blood stem cell or bone marrow transplant have a fully matched genetic donor within their family. When they need to find a donor they turn to NMDP, who has managed the most diverse registry in the world for more than 25 years and impacted more than 125,000 lives. At NMDP, we believe we believe each of us holds a key to cure blood cancers and disorders. With the help of blood stem cell donors from the world's most diverse registry and our extensive network of transplant partners, physicians and caregivers, we are expanding access to treatment so that every patient can receive their life-saving cell therapy. Information will be shared on how the patient & donor matching process works; the donor experience; and how students, faculty, staff and others can join the life-saving movement.

16 - Heat Evolution of the Bacterial Microbiome Found in Heat Evolved *Cladocopium* C1acro

Julia Nuss, Geoffrey Mitchell

Wofford College, Spartanburg, SC

Mass coral bleaching events are affecting our reef ecosystems. One approach to minimizing bleaching has been the experimental evolution of the coral endosymbiont Cladocopium C1acro with the goal to raise more heat tolerant algal symbionts. Among the many differences between these heat evolved (SS) symbionts and their wild type (WT) counterparts is their bacterial community composition and stability. It has been previously assumed that these bacterial symbionts have evolved alongside their algal host. Here, we examine the heat tolerance of SS8- and WT-derived Marinobacter and the whole bacterial community by measuring growth rate of the bacteria at 27°C and 31°C. In both the Marinobacter and community cultures, the WT-derived grew significantly better at 27°C whereas the SS8-derived Marinobacter grew significantly better at 27°C and the SS8-dervied community grew the same at both temperatures. The SS8-derived bacteria's performance at 31°C may be due to selective pressures that evolved traits more advantageous to the bacteria's symbiotic relationship with the algae other than cell division rates. Future research should evaluate heat evolution in more individual bacteria species and through means other than cell division alone.

17 - Polyunsaturated fatty acids (PUFAs) cause changes in growth, membrane permeability, biofilm formation, motility, and phospholipid structure in the human pathogen Aeromonas hydrophila

Gillian Morton, Meredith Grant, David Giles

The University of Tennessee at Chattanooga, Chattanooga, TN

Aeromonas hydrophila is a gram-negative bacterium commonly found in warmer, freshwater climates, typically affecting humans and fish. In humans, the pathology of A. hydrophila presents itself through skin and tissue infections, gastritis, and septicemia. This bacterium enters the body through contact with contaminated water. Additionally, due to A. hydrophila's pervasiveness in fish, it can be passed to humans through ingestion of contaminated organisms. Many treatments for this bacterium are currently ineffective due to its antibiotic resistance. It is becoming increasingly evident that gram-negative bacteria utilizes polyunsaturated fatty acids (PUFAs) for membrane remodeling and phenotypes associated with virulence. This study explores the effects of PUFAs on A. hydrophila's growth, membrane lipid assimilation, permeability, swimming motility, and biofilm formation. Supplementation of PUFAs during growth in minimal media revealed inhibitory effects of alpha- and gamma-linolenic acids. Variable growth effects were observed over 12-hour growth curves for A. hydrophila in the presence of seven physiologically relevant PUFAs. Interestingly, several PUFAs (18:2, 20:3, 20:4, 20:5, 22:6) supported growth as the sole carbon source. Most notably, docosahexaenoic acid (22:6) showed significant evidence of fatty acid utilization as a carbon source. Thin layer chromatography indicated assimilation of PUFAs into the major phospholipids of A. hydrophila. Uptake of the hydrophobic dye crystal violet was significantly increased when arachidonic acid (20:4) was supplemented, raising membrane permeability by 25%. Swimming motility was variable affected by PUFAs. Assessment of biofilm formation revealed differences depending on exposure to each PUFA. Collectively, the data highlights A. hydrophila's ability to utilize exogenous PUFAs for physiological and behavioral purposes.

18 - Antibiotic Properties of Cedarwood Oil

Mia Hoffman

Guilford College, Greensboro, NC

More than 2.8 million antimicrobial-resistant infections occur each year in the United States. Antimicrobial resistance is an urgent public health issue witnessed globally and we need to do what we can to prevent new resistance from developing and to stop the spread of resistance that already exists. Many plant materials such as cedarwood oil, have shown to have anti-inflammatory and antimicrobial properties. One study in particular found that *Escherichia coli, Bacillus subtilis* and *Bacillus cereus* were sensitive to cedarwood oil and showed bactericidal activity. In the current study we compared the effectiveness of steam distilled or commercially produced oil. The oil from needles and wood of a cedarwood tree where isolated by steam distillation. Antibiotic properties of the compounds were assessed Minimum inhibitory concentration (MIC) assay and Kirby Bauer Assay.

19 - Daily prebiotic consumption of sweet potatoes shifts abundances of key gut microbiota connected to gut health

Alexis Gallegos[1], JohnEric Smith[2], Richard Baird[2], Shawn Brown[1]

[1]*University of Memphis, Memphis, TN,* [2]*Mississippi State University, Starkville, MS*

Diet plays a large role in maintaining a healthy community of gut microorganisms, which impacts many aspects of human health. Probiotics and prebiotics are two components of diet that can influence the gut microbiome. Prebiotics are foods that are not digestible by humans that stimulates and promotes the growth of beneficial microorganisms within the gut. Sweet potatoes contain high levels of resistant starches and dietary fiber which healthy gut microorganisms can metabolize and will stimulate growth of beneficial microbiota. In this study, we tested if daily sweet potato consumption for thirty days shifts gut prokaryotic communities and the diversity of key short chain fatty acid (SCFA) functional genes known to be important for human health associated with butyrate and propionate production pathways. To do so, we collected four fecal samples from each healthy adult volunteer, two prior to and two after daily sweet potato consumption. From these, we conducted metabarcoding using a combination of Fluidigm microfluidic access arrays and Illumina NovoSeq sequencing targeting bacterial and archaeal 16S regions as well as the functional genes butyrate kinase (*Buk*), butyryl-CoA:acetate CoA transferase (*But*) involved in butyrate production and the methylmalonyl-CoA decarboxylase a-subunit (*mmdA*) which is part of the succinate-based propionate pathway. In doing so, we have unprecedented sequencing resolution to disentangle host variation and prebiotic impacts on gut health. Our results indicate that key gut taxa respond strongly to sweet potato consumption, but this is a protracted impact whereby regular consumption can prime conditions to facilitate these shifts. Further, key functional genes show shifts in phylogenetic diversity indicative of more robust SCFA production with sweet potato consumption. These results provide

insights into diet-induced gut health and establish connections between gut community shifts and functional gene diversity, which builds a foundation for diet-driven gut health.

20 - Creating synthetic microbiomes to understand ecological interactions involved in the snake fungal disease system

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An appreciation of microbiomes has changed the way we think about disease. Snake Fungal Disease (SFD), caused by the microbe, Ophidiomyces ophiodiicola (Oo), can be understood as an imbalance of the microbiotic community, facilitating an increased growth and dominance of Oo . As a community ecology problem, microbes can facilitate or inhibit Oo growth through ecological processes either directly or indirectly. Previous studies have shown interactions of microbes in synthetic systems mimicking the snake skin microbiome. We tested the indirect effects of microbes on the growth of Oo on petri plates, with minimal media, and keratin(the major component of snake skin) as the only carbon source. The minimal keratin media was inoculated with two bacterial members of the snakeskin microbiome isolates associated with the presence or absence of infection with Oo, Stenotrophomonas sp. and Chryseobacterium sp. and each allowed to grow for 24 hours, in minimal broth medias, with and without keratin. The media was vacuum filtered, so that only indirect effects of metabolizing the media would affect later growth. A subset of each media was then subjected to incubation with the opposite microbe to test for possible serial effects, as well as a simple additive treatment made by mixing the original two spent medias. These spent media were incorporated into minimal agar plates, inoculated with Oo, and Oo growth was monitored every two days for fourteen days. The fungus showed strong growth in keratin media compared to the minimal media. While there was strong growth of the bacteria in keratin media, single and additive treatments did not differ from un-inoculated keratin media. Serially inoculated keratin media, showed less growth, which might be explained a number of ways. One serial treatment caused a phenotypic change in the hyphal growth of Oo, and we will explore this further.

21 - Presence and Identification of Entomopathogenic Fungi and their Pathogenicity against Millipede Species in Coastal Georgia

Kristin Bailey, Jennifer Zettler, Nhien Le

Georgia Southern University, Armstrong Campus, Savannah, GA

Recently in Savannah Georgia, multiple different millipede species have been observed exhibiting pre-death climbing behavior then subsequent death in odd places. Entomopathogenic fungi are well known, species-specific pathogens of a wide diversity of insects that have developed a way to infest, manipulate, and kill their insect hosts to complete their life cycle and sporulate. Scientists just recently documented the first case of a fungus, *Arthrophaga myriapodina,* infesting species of cyanide-producing polydesmid millipedes. We assessed the pathogenicity and presence of entomopathogenic fungi in millipede species across Savannah, Georgia; both in the field and in the lab. Eventually confirming that an entomopathogenic fungus is infecting two species of millipedes in the genus *Eurymerodesmus* around coastal Georgia. This is the first documentation of entomopathogenic fungi infecting any species within the family Eurymerodesmidae.

22 - Emodepside on L4 C. elegans

Malia Bennie, Brian Ellis

Lipscomb University, Nashville, TN

It is estimated that nearly 1.5 billion people worldwide are infected with at least one species of intestinal parasite whipworm, hookworm, or roundworm (Weaver et al). Emodepside is a drug in veterinary use that is used to deworm intestinal parasitic nematodes. Emodepside binds to presynaptic lactrophillin receptors in nematodes paralyzing the pharynx and other somatic musculature (Harder et al). In a recent study, patients that used Emodepside to treat hookworm had a 95% cure rate after taking 30mg (Mrimi et al). *C. elegans*, a free living nematode, is cost-effective and has been shown to be a powerful model organism for anthelmintic study, as they are in the same phylum as the parasitic worms (Weaver et al). We have examined the effects that different concentrations of Emodepside have on *C. elegans* and observed the motility and death rate of the worms over a 7-day period by scoring them with a 0-3 health score scale. Results showed *C. elegans* treated with the Emodepside had an average health rating of 1.25 compared to controls which had on average a 2.77 health rating.

23 - Systematics of the Viola palmata (Violaceae) Species Complex Using Morphological and Genetic Data

Jonathon Osborne

University of Southern Mississippi, Hattiesburg, MS

Members of the genus *Viola* are widespread throughout the Northern Hemisphere and high elevations in the Southern Hemisphere. With an estimated 660 species among 31 sections, *Viola* is among the largest genera in the world. Despite this, the ecology and classification of the genus has been understudied in the Southeastern US. The *Viola palmata* group in particular has been historically confused, split, and/or synonymized by past researchers even since Linnaeus's initial description in his *Species Plantarum* (1753). With only cursory or confounding information having been brought forth to describe this species group, the Alford Lab at USM in conjunction with the Ballard Violet Lab at Ohio University have set out to clarify this complex species group. We seek, through traditional as well as modern genetic, ecological, and morphometric evaluative methods, to determine the number and circumscription of species in this group. Genetic analyses include sequencing of the nuclear ITS and microsatellite loci. A multitude of morphological characters among sampled

populations and herbarium specimens are being evaluated; these morphological characters include chiefly seed coat texture and colour, sepal and auricle shape, and lobed leaf dimensions. The data collected thus far suggests some consistent morphological character differences among large-scale ecoregions in the southeast (Piedmont, Gulf Coastal Plain, etc.). Thus far, a total of 102 individuals from 18 sampled populations have been brought to USM for a common garden experiment and closer observation. Tissue samples have been collected from several additional populations whose abundance would not sustainably support live collection.Along with these live specimens, more than 450 herbarium specimens of *V. palmata* L. and allies from the region are on loan to USMS for further examination and to supplement geographic gaps in sampling.

24 - Untangling Interspecific Relationships Between Aquatic Taxa in the Moss Genus Fissidens

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Bryophytes live in a diverse array of habitats from blazing deserts to arctic tundra. They can also occupy habitats ranging in moisture level from terrestrial to partially aquatic to completely submerged. Often when species move into aquatic habitats they lose morphological features, which can make it challenging to elucidate evolutionary relationships based on morphology. Species in the moss genus *Fissidens* reside in habitats across a range of moisture levels from terrestrial to aquatic. In this study our aim was to determine the evolutionary relationships between fully aquatic *Fissidens* species, including members of Subgenus *Octodiceras* and Section *Sarawakia,* which contains *Fissidens brachypus,* a species that grows exclusively on amazonian sponges. We conducted a molecular phylogenetic study using data generated from herbarium specimens. A total of 27 species were sequenced and analyzed, ten of which are fully aquatic. Using a target-capture approach with the GoFlag408 probe set, we recovered hundreds of gene regions for each specimen, including a specimen collected in the year 1842. The resulting sequences were put through a series of processing scripts to clean and align the data for further analysis. The resulting files were then used to build two trees: a concatenated Maximum Likelihood (ML) tree and a coalescent-based ASTRAL species tree. The concatenated ML tree and ASTRAL coalescent-based tree yielded nearly identical results with both Subgenus *Octodiceras* and Section *Sarawakia* being polyphyletic. Using the resulting trees, we tested for correlations between leaf length and habitat moisture. After the correlations were phylogenetically corrected, no relationship was found. This study expands our understanding of habitat transitions and morphological evolution across plants.

25 - A review of the Rhododendron viscosum group: taxonomic challenges.

Charles Horn

Newberry College, Newberry, SC

Rhododendron viscosum has been variously viewed over the last century, either as a single variable species (Kron 1993), or as a cluster of species and varieties (Rehder 1921). Rehder recognized three species in the group (*R. oblongifolium*, *serrulatum*, and *viscosum*). A fourth species (*R. coryi*) has been since recognized by some. Morphological features used to separate these species include plant height, leaf pubescence, floral bud scale number, corolla tube length, and potential stoloniferous growth. Beyond species level, eight varieties and four formas were recognized by Rehder, in part, based on pubescence of leaves, stems, and floral buds. Recent work in the Carolinas has shown that variation can occur within and between populations related to plant height, stoloniferous habit, color of corolla glandular hairs, and the extent of floral scale pubescence. An important observation is that much variation can even be seen within a population, thus emphasizing the value of field work in addition to review of herbarium specimens.

26 - Whole chloroplast genome sequencing improves support in the Coccoloba (Polygonaceae) phylogeny and provides taxonomic and biogeographic insights

Daniel Koenemann[1], Joilson Viana Alves[2], Juan José Ancona[3], Juan Javier Ortiz Díaz[4], Janelle Burke[5]

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Species richness in the New World tropics is very high. In the West Indies, adaptive radiation and vicariance have generated a large number of plant species with a high degree of endemism. Many of these plant groups are tropical trees. One such genus of tropical trees is *Coccoloba* P.Browne (Polygonaceae), estimated to encompass somewhere between 150 and 400 species. In order to improve the *Coccoloba* phylogeny as well as our understanding of evolution and taxonomy in the genus, we here *de novo* assembled and annotated 23 *Coccoloba* chloroplast genomes. We used these chloroplast genomes to reconstruct the *Coccoloba* phylogeny using three methods: IQ-TREE, RAxML, and BEAST. We also used the plastome annotations to evaluate the nucleotide diversity (Pi) among the Brazilian species and the Mesoamerican and Caribbean species of *Coccoloba*. All three reconstruction methods recovered the same topology for the *Coccoloba* phylogeny, with generally strong node support across the tree. Nucleotide diversity calculations revealed more sequence variation among species from Brazil than among species in Mesoamerica and the Caribbean. The recovered phylogenetic topology confirms some preliminary conclusions derived from the most recent *Coccoloba* phylogeny. The genus likely has a Mesoamerican origin. There is a major phylogenetic and biogeographic disjunction between the Brazilian species and the species from Mesoamerica and the Caribbean. Long distance dispersal has likely played a major role in the evolutionary history of *Coccoloba*. The phylogeny presented here also introduces for the first time the possibility for adaptive radiation and ecological speciation in both the Caribbean and Brazil. Moreover, the phylogeny presented here provides the first evidence for the non-monophyly of two sections of the *Coccoloba* subgeneric sectional system. Finally, the phylogeny presented here provides the first evidence of weak species boundaries in the genus.

28 - The Seymerian Chronicles

Ben Gahagen

Abraham Baldwin Agricultural College, Tifton, GA

Seymeria (Orobanchaceae) is a relatively small genus of root hemiparasites with approximately 17 species distributed throughout the southern United States and Mexico. With only a few species included in recent phylogenetic studies, there is a dearth of information regarding the evolutionary relationships within the genus and where they are located within the Pedicularideae tribe. Similarly, while there are numerous studies investigating the growth aspects of *S. cassioides*, little is known about the sympatric species, *S. pectinata.* This presentation aims to use results from numerous studies to update the current knowledge on the systematics of *Seymeria* and growth aspects of the two species distributed in the southeastern United States, *S. cassioides* and *S. pectinata.*

29 - Assigning c-values to Tennessee's flora.

Sevyn Brothers, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

Anthropogenic land-use change and intensification since pre-European settlement have significantly affected the integrity of our natural ecosystems, causing strong biodiversity loss and therefore the allowance of opportunistic generalist species to overtake more conservative species. Ecosystem integrity is defined as "the extent to which the composition, structure, and function of an ecosystem fall within their natural range of variation," and loss of ecosystem integrity is not restricted to any one type of ecosystem. While methods to measure ecosystem integrity exist, often years of field-experience are necessary to make accurate assessments. Over the past 20 years, the Floristic Quality Assessment (FQA) has been more frequently used to easily compare the intactness and quality of sites. At its core, FQAs consist of only two parts: a species checklist and their corresponding coefficient of conservatism (c-value). C-values are bipartite, in that the first prong is how tolerable a species is to anthropogenic disturbance, and the second being a species' fidelity to a specific habitat. Much work across the US has assigned c-values to many species; however, this work is incomplete because a species may have different c-values across different parts of its range. While it is more accurate to assign c-values per species per physiographic region, applying c-values at the state level is common practice due to resource allocations. Tennessee's c-value assignment is incomplete for a suite of reasons. While a small slice of the wetland species have published c-values, the vast majority of Tennessee's species have informal assignments. To expedite the process of completing c-value assignment, we are analyzing c-values provided by twelve experienced botanists, published c-values for a small percentage of Tennessee's wetland species, and seven databases regarding Tennessee species outside of the state's political boundary. To date, we have effectively assigned values to 75% of Tennessee's flora.

30 - Morphometric analysis of the Packera dubia (Spreng.) species complex

Elizabeth Fleming

University of North Carolina, Chapel Hill, NC

Packera dubia is a member of the *Packera* genus, a member of the *Aureoid* subgroup within the *Senecio* super-genus known for its morphological variability and difficult classification. *P. dubia* is widely distributed across eastern North America, with disjunct populations along the gulf coastal plain and midwestern United States. Variation in *P. dubia* morphological traits by region suggest the existence of one or more distinct taxa within the species. J.K. Small's Manual of Southeastern Flora described *Senecio alabamensis* as a similar, but distinct, species to *P. dubia,* formerly *S. tomentosus,* with a distribution along the gulf coastal plain and varied morphology. *Senecio alabamensis* was eventually lumped in with what is now named *P. dubia*. For this project, morphological traits across four regional groups (Atlantic coastal plain, gulf coastal plain, granite flat rocks and domes of the piedmont, and Western prairies) were examined to determine whether the regional groups warrant taxonomic division at the species and varietal ranks. Specimens of *P. dubia* obtained from herbariums across the southeast were measured based on several vegetative and floral characters. The morphological data were categorized and visualized using a clustering analysis, principal coordinate analysis, and linear discriminant analysis. We expect to observe sufficient variation between the populations, especially in indumentum variability and basal leaf data. Initial results suggest that taxonomic seperation is warranted at the species, and possibly, varietal rank with the piedmont and mid-Atlantic populations forming one clade and the gulf coastal plain and Western prairie populations forming a second, geographically distinct clade.

31 - Modeling Subnational Conservation Status Ranks for Tennessee Vascular Plants

Julia Prins, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

Plants are crucial components of our earth's ecosystems and understanding their risk of extinction is important for ensuring effective and efficient conservation. Conservation status ranks measure this potential risk for species at the global, national, and subnational levels, taking into account rarity, threats, and species population trends. These ranks impact development initiatives, guide land management practices, and help establish conservation priorities, it is therefore important to have a completed list of conservation status ranks for all species. It is equally important that these ranks are generated using a standardized system to reduce bias and misranking. The NatureServe ranking system has been in use since 1978 and has generated over 100,000 conservation status ranks from critically imperiled to secure. NatureServe uses a standardized rank calculator based solely on scientific data with ten criteria each weighted a unique amount. There are currently 1,792 vascular plants in the state of Tennessee that are unranked under the NatureServe ranking system. Subnational conservation status ranks will be generated for vascular plants present in Tennessee using two analyses to get an estimate of rank, which will then be compared against ranks generated by three tools based on NatureServe's rank calculator. The first

analysis looks at s-ranks assigned in the states surrounding Tennessee and the second is based on the percentage of counties the species is present in. The three systematic tools being used are a Feature Manipulation Engine workflow, a series of expressions written in Arcade on ArcGIS Pro, and a Shiny app called RareCat. Each tool uses occurrence data from SERNEC and GBIF to calculate range extent, area of occupancy, and number of occurrences from which an s-rank is determined. Using these various tools, we will progress towards a complete list of s-ranks for Tennessee plants, tremendously assisting conservation efforts.

32 - Windthrow and salvage logging alters herbaceous species composition but not Shannon diversity in short-term study of Georgia longleaf pine woodlands

Austin Menzmer[1], Jeffery Cannon[2], Lisa Giencke[2], Chris Peterson[1]

[1]University of Georgia, Athens, GA, [2]The Jones Center at Ichauway, Newton, GA

Fire-frequent longleaf pine woodlands of the southeastern US are imperiled ecosystems that support a high diversity of herbaceous species. However, severe disturbance from wind is expected to increase with climate change, so it is crucial to understand how disturbances impact plant diversity. Few studies have analyzed the effects of wind and salvage logging on herbaceous species diversity and composition in longleaf pine woodlands - a layer containing over 90% of woodland species. Here, I present a study of wiregrass-dominated longleaf pine woodlands effected by Hurricane Michael in 2018 and subsequent salvage logging and analyze how herbaceous diversity and composition differ between areas of varying damage three years post-disturbance.

In 2021, twelve sites were established and sampled at the Jones Center at Ichauway in Georgia; six in unsalvaged stands and six in salvaged stands. At each site we established one plot within a canopy gap created by Hurricane Michael and one within an adjacent intact woodland. Each plot contained three 1 m^2 sampling quadrats in which we recorded species presence and abundance (percent cover; diversity calculated using the Shannon index). This experimental design examined four severity treatments: unsalvaged gap, unsalvaged nongap, salvaged gap, and salvaged nongap. Herbaceous diversity did not differ between treatments with varying canopy cover or presence of salvage logging. Herbaceous composition did not differ between severity treatments except for the unsalvaged gap vs. unsalvaged nongap comparison.

These data support two conclusions: 1) wind and salvage logging plus the unexamined disturbance of fire both pre- and post-Michael does not change herbaceous diversity; 2) disturbances that occurred post-Michael such as salvage logging and fire may obscure the impact of wind disturbance on herbaceous composition. This work suggests that disturbances at present levels of frequency and severity have minimal impact on composition and null impact on the diversity of herbaceous species.

33 - A Floristic Inventory of the Walls of Jericho Forever Wild Tract, Jackson County, Alabama

Garrett Billings[1], T. Wayne Barger[2], Joey Shaw[1]

[1]University of Tennessee at Chattanooga, Chattanooga, TN, [2]State Lands Division, Natural Heritage Section, Alabama Department of Conservation and Natural Resources, Montgomery, AL

The Walls of Jericho Forever Wild Tract is a 5,142 ha protected area in Jackson County, Alabama, that was acquired through purchase by the Alabama Forever Wild Program in 2004. It is largely a dry oak/pine/hickory successional forest over calcareous soils and karst outcrops that was last cut in the 1970's. Other notable communities included rich cove, ruderal grasslands, sandstone glades, seepage forests, and buttonbush ponds. Limestone and sandstone cliff-faces and outcrops were abundant throughout. The vascular plant flora was documented during the 2021-2023 growing seasons. In total, 32 collection trips and 54 field days resulted in documenting 709 species in 373 genera in 125 families. As is typical for the Southeast US, Asteraceae, Poaceae, Cyperaceae, Fabaceae, and Rosaceae were the most species-rich families. Forty-four rare taxa were documented including several notable species such as the federally listed Platanthera integrilabia (Orchidaceae) and the globally rare species Viburnum bracteatum (Viburnaceae). The introduced species component was normal for this region with 85 species (12% of the flora) documented. Significant time was also spent searching for two federally listed species, Clematis morefieldii (Ranunculaceae) and Apios priceana (Fabaceae) because these species are both known from near the site; however, neither species was observed within the study site.

34 - Preliminary Analysis of a Vascular Flora of Booker T. Washington State Park in Hamilton County, Tennessee.

Sevyn Brothers, Julia Prins, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

Booker T. Washington State Park is a 353-acre tract located on the Chickamauga Reservoir of the Tennessee River northwest of Chattanooga. It was developed by the Tennessee Valley Authority (TVA) as the state's second African American recreation area and was leased by the state from TVA in 1938. Tennessee's division of state parks completed construction in 1950 when it was formally deeded to the state. The park is characterized by dry-mesic calcareous forests and acidic sandstone ridges in the Southern Ridge and Valley. Successional forests occupy the park as original forests have been repeatedly cut. While a work in progress, here we report on some characteristics of the flora, represented by 88 families, 183 genera, and 272 species and lesser taxa. The three most represented families are Asteraceae, Poaceae, and Fabaceae, and the two most represented genera are *Quercus* and *Viola*. Ninety-two percent of species are angiosperms, of which there are 195 eudicots, 54 monocots, and seven magnoliids. Only 4% pteridophytes and 2% gymnosperms make up the remainder of the flora. Nonnative species make up 27% of the species, and much of the park's lower elevations are dominated by *Hedera helix*, *Ligustrum sinense.*, *Microstegium vimineum*, and advancing populations of *Nandina domestica*. While there are no federal or state listed species on site, there are records of two G1 species (*Quercus stellata, Q. shumardii*), two S1 species (*Coreopsis major, Triadenum virginicum*), and two S2 species (*Carex lupulina, Trillium luteum*). While Booker T. Washington State Park was never known to contain rare or conservative species, there are rare and conservative species known from

the surrounding region. One reason for this baseline botanical survey is to provide data for the land managers and conservation workers who may seek funding and future projects to restore the ecological integrity of this old, historical state park.

35 - Herbivore-induced defenses impact floral colonization and pollinator behavior

Dr. Grace Freundlich

Furman University, Greenville, SC

Conserved phytohormone signaling allows plants to maximize finite resources available for growth, defense, and reproduction. However, when plants are stressed, conserved signaling results in adverse, unintended tradeoffs that affect plant fitness and multi-trophic level interactions. These tradeoffs are especially apparent between growth-defense tradeoffs in flowering plants. Herbivore species-specific defenses can elicit differential plasticity in a host's phenotype, resulting in ecological costs potentially mediated through labile flowers and the mutualists they attract. Flowers, which are inherently linked to reproduction, facilitate interactions with other community members, including microbes that colonize floral organs, rewards, and ultimately, seeds. Additionally, herbivory can shift host metabolism by altering floral reward and scent chemistry, potentially shifting patterns of floral microbe colonization via the extended floral phenotype that indirectly effects pollinators. We tested how timing of herbivory impacts floral microbiome assembly and consequent pollinator preferences in the mustard *Brassica juncea*. Plants were either damaged by the caterpillar *Tricoplusia ni*, the aphid *Brevicoryne brassicae,* or left as undamaged controls. While herbivory alone had no effect on pollinator attraction, timing of herbivory significantly impacted pollinator foraging bouts and consequent fruit production. *B.brassicae* damaged plants were visited less often relative to control plants and while *T.ni* plants were unaffected. Interestingly, herbivore damage from *B.brassicae* damaged resulted in decreased bacterial colonization relative to *T.ni* damaged and control plants. To determine if these affects were related to defense induction, we conducted invitro tests with synthetic nectar and found that salicylic acid reduced bacterial performance via reduced colony counts. Although *T.ni* damaged plants had more attractive floral rewards, *T.ni* damaged plants harbored less bacterial counts relative to other treatments. These differences have significant implications for other multi-trophic interactions, including plant-pathogen-pollinator interactions and act a springboard for future studies

36 - The State of Herbaria in Tennessee

Meredith Woodward, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

Most of the herbaria in Tennessee were the focus of National Science Foundation awards to facilitate the digitization of the state's herbaria between 2016-2019 (NSF #1410069, NSF #1410087, NSF #1756382). Today, twelve of TN's thirteen herbaria house more than 887,230 specimens that are digitized to varying degrees and can be accessed through SERNEC. Utilizing the DarwinCore .csv files for each herbarium, this work aims to summarize the herbaria individually and collectively for the first time to provide an update on the content and features of each institution. Furthermore, it will provide insight on gaps within the data, three of which will be showcased in this presentation: 1. Missing data in important DarwinCore fields, such as date, collector, geographic coordinates, or municipality, 2. Collection biases across Tennessee that have resulted in over- or under-collected counties or regions of the state, and 3. Variation in taxonomy across time and taxonomic concepts that complicates summarizing the florisitc composition of each of the herbaria and the state as a whole. Ultimately, we anticipate this summary of the state's herbaria will contribute to highlighting the substantial and long-standing resources that are our state's herbaria and how workers may guide more focused field collection and digitization efforts to enhance our state's botanical data in more useful directions.

37 - Quantifying the National Park Herbarium Specimens at the University of Tennessee at Chattanooga Herbarium (UCHT)

Quinn Towery

University of Tennessee at Chattanooga, Chattanooga, TN

Tennessee is home to 13 herbaria, of which 12 are associated with universities and one is a federal herbarium in the Great Smoky Mountains National Park (GSMNP). While GSMNP is somewhat unique among national parks in having a herbarium, many other National Parks house their herbarium specimens across untold numbers of herbaria. Through use of the University of Tennessee at Chattanooga Herbarium (UCHT), it became apparent to curators that it contained a relatively high number of specimens collected from many different national parks. Most of these specimens were collected in the 1950s-1980s. The purpose of this project was to: locate all of the specimens within UCHT that were collected on land owned by the National Park Service; database these specimens in regard to the history of any scientific name changes, the park in which they were collected, and NPS barcodes that are separate from UCHT barcodes/catalog numbers; segregate them into separate brown-stripe folders; record any damage on a scale from 0-3; and analyze trends among the specimens collected within these national sites. Through our efforts we identified ~3000 specimens collected from within 50 national parks of six countries (US, Canada, Kenya, Bahamas, Iraq, and Mexico) and 17 US states. The NPS site with the highest number of specimens is the Chickamauga and Chattanooga National Military Park. Specimen quality is generally high with ~88% in excellent condition with no signs of degradation. The remaining ~11% with moderate damage, and 24 specimens with significant damage, are almost entirely rehoused specimens from Southern Missionary College, moved to UCHT to prevent further degradation.

38 - A Vascular Flora of Bark Camp Barrens WMA in Coffee County, Tennessee

Quinn Towery

University of Tennessee at Chattanooga, Chattanooga, TN

Bark Camp Barrens Wildlife Management Area (BCB) is a 1,395-ha area located in Coffee County, Tennessee. BCB is owned and managed by the Tennessee Wildlife Resources Agency and is included in the Eastern Highland Rim Prairie and Barrens Conservation Opportunity Area. BCB occurs in the Barrens region of the Eastern Highland Rim physiographic region, an area typified by flat to gently rolling hills and acidic unproductive soils. The Barrens region of Tennessee hosts numerous populations of disjunct Coastal Plain plant species such as *Dichanthelium wrightianum* and *Mnesithea rugosa* (Poaceae). Although the Barrens of the Eastern Highland Rim are floristically diverse and intriguing, few comprehensive floristic studies of this region have been published. When compared to the adjoining physiographic regions of the Cumberland Plateau (10 published floras in TN) and Central Basin (3 published floras), the Eastern Highland Rim only contains 1 published flora, Short Mountain, which isn't representative of the EHR Barrens and more closely resembles the flora of the Cumberland Plateau. It is the goal of this study to catalog all vascular plant species within BCB, create a better understanding of the vascular flora of the Eastern Highland Rim Barrens as a whole, and identify pathways to protect additional Eastern Highland Rim Barren sites within the state. To date we have collected 309 specimens and identified 291 taxa from 70 families and 167 genera. Here we would like to give an update on our progress from the previous field season and showcase our ongoing efforts to create a better understanding of the vascular flora of the Eastern Highland Rim Barrens.

39 - Preliminary Vascular Plant Flora of Cloudland Canyon State Park, Dade County, Georgia.

Andy Wall, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

Cloudland Canyon State Park (CCSP), situated in Dade County, Georgia, spans more than 1,431 hectares and is managed by the Georgia Department of Natural Resources. This park lies at the southern extent of the Cumberland Plateau ecoregion, an area that has received limited attention in terms of floristic studies compared to its northern counterparts in Tennessee and Kentucky. CCSP encompasses diverse habitats across its elevation range (240-600 meters) featuring higher elevation ridges with dry acidic soils, a canyon floor with moist rich, more alkaline soils, and a treacherous escarpment in between. This environmental variation presents a wide range of ecological niches, likely hosting a diverse array of species. Our research aims are to (1) catalog all vascular plant species within CCSP, contributing valuable insights to the understanding of the flora of the southern Cumberland Plateau in Georgia, and (2) to employ statistical habitat modeling tools to identify new occurrences of rare plant species within the park. Through our own collections, data compiled from citizen science observations (iNaturalist), and digitized herbarium specimens from the site SERNEC, we have created a preliminary floristic checklist comprising 496 species in 276 genera in 108 families. The largest plant families so far are Asteraceae with 66 species, Ericaceae with 22 species, and Fabaceae also with 22 species. Nonnative species make up about 8% of the flora. The federally listed *Spiraea virginiana* (Rosaceae) was previously known from the site.

40 - What's in our herbarium? Bionomia and Wikidata facilitate a case study on the botanical career of Richard W. Simmers, Jr.

Shawn Krosnick

Tennessee Tech University, Cookeville, TN

Digitization of natural history collections has revolutionized access to specimen data and allowed us to make large-scale inferences that were previously impossible. These data are entered into fields that follow common standards (e.g., Darwin Core) so the information may be effectively queried. One aspect that has come to light is the challenge associated with human names for collectors and identifiers. These names are currently stored as text strings, making it very difficult to consistently link people with their contributions. For example, a specimen with the collector name "Mrs. E. B. Johnson" could be the same individual whom on other specimens is listed as Lidia Johnson, yet these collections remain unlinked because they each have a unique text string. Fortunately, new tools are available to facilitate attribution and improve the quality and consistency of name use, including ORCID, Bionomia, and WikiData. These tools are free and open, meaning anyone can add and improve data about the people involved in documenting biodiversity, weather dealing with current or historical records. One of the challenges with these new techniques is the attribution of specimens when the individual is still alive but is unable or unwilling to provide the data needed to establish ORCID and Wikidata profiles. I provide an example of this process by working with Richard W. Simmers, Jr., an important plant collector in the eastern United States for at least the past 50 years. Not only has this process informed us about the breadth and strengths of our own herbarium (HTTU), it reveals information on duplicate and/or complementary specimens held at other collections around the world. With this approach, all of his collections and identifications are connected under a single profile in Bionomia, giving a much more complete picture of his total contributions to his field.

41 - Common ground of fellow botanists: Lena Artz (1891-1976) and Francis W. Hunnewell, II (1880-1964) in the Shenandoah Valley.

Andrea Weeks

George Mason University, Department of Biology and Ted R. Bradley Herbarium, Fairfax, VA

The Shenandoah Valley was once home to a pioneering botanist of the Massanutten Mountains, Lena Clemmons Artz (1891-1976). A high school biology educator and founding member of the Southern Appalachian Botanical Society, Artz dedicated her life to documenting the unique plant communities of Shenandoah and Rockingham Counties of Virginia and advocating for their preservation.

Until an archive of her field notebooks and personal papers was discovered, little was known about her beyond her published papers and scattered herbarium specimens. This presentation summarizes findings from this archive and her exsiccatae to illuminate her life's work and how it unexpectedly intersected with that of another unsung, resident botanist of the Shenandoah Valley, Francis W. Hunnewell, II. A Massachusetts attorney and prolific botanical collector with lifelong ties to Harvard, Hunnewell became a Virginian by choice as the last private owner of Belle Grove Plantation. Despite their differing backgrounds and education, he and Artz had much in common and conducted fieldwork together at a critical time during the exploration of Virginia's flora in the early to mid-20th century. Today, burgeoning digital resources from natural history collections and new tools for their analysis can reveal hidden chapters in the history of science. These very human stories are effective means for engaging new audiences in appreciating the rich biodiversity of the southeastern US, understanding its precarity in the Anthropocene, and learning how natural history collections are more important than ever.

42 - Buzzing Havens: Plant-Insect Interactions in Pollinator Gardens and Bee Hotels

Maria Escobedo, Bailey Lankford, Camila Filgueiras

University of North Carolina at Asheville, Asheville, NC

Pollinating insects promote plant diversity, increase stability of ecosystems, and maintain reproductive success of a majority of flowering plants; therefore, monitoring of plant-pollinator interactions are necessary for conservation efforts. Little research is available on pollinator communities at the local scale for the South-Eastern United States. Our investigation aimed to assess the plant-insect interactions at UNC-Asheville by evaluating the abundance, diversity, and species assemblages of plant and insect taxa. Data collection lasted for 6 weeks between July and August 2023 at Garden 1 and Garden 2. Morning and afternoon visual surveys were conducted weekly. In each garden, six plants were observed for 10 minutes each during which any adult insect interactions were recorded and identified to order. Simultaneously, colored pan traps (yellow, green, blue, and white) were installed at six random sites within each garden. A 24 hour collection period occurred every week and samples were identified to family. Plant species in both gardens were identified before and after visual surveys and pan trap collections. Plant assemblages differed greatly between gardens with 21 species only found in Garden 1 and 24 species only in Garden 2. Majority of plants in Garden 1 produced white and yellow flowers, while most plants in Garden 2 produced white and purple flowers. Overall, Garden 2 had more insect diversity than Garden 1 for both visual surveys and pan traps. Yellow flowers attracted a higher diversity of insects than purple or white flowers. Green and yellow pan traps had the highest insect diversity between both gardens and pan trap colors. Andrenidae and Apidae had the highest abundance in blue traps, but abundance was not significantly higher for the order Hymenoptera. Green pan traps had a higher abundance of Hemiptera, Cicadellidae, Dolichopodidae, and Mordellidae. Yellow pan traps collected more Diptera, Hemiptera, Cicadellidae, and Dolichopodidae.

43 - How Prescribed Burns Affect Soil Arthropods: Duration and Dynamics

Abigail Levinson[1], Jonathan Horton[2], Camila Filgueiras[1]

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Soil arthropod assemblages are widely impacted by changes in their soil environment. Many organisms complete essential tasks and provide structure to the soil. Moisture levels, nutrient retention, and the decomposition of organic matter all rely on soil organisms. The biodiversity of these organisms can be impacted by natural disasters that occur in their environment. Negative impacts of wildfire include loss of air quality, crops, and animals. However, burning also contributes to forest health, providing necessary heat for the germination of plants, and clearing the way for successive growth. Controlled burns are prescribed to supply the benefits of burning while avoiding much of the collateral damage associated with wildfires. The goal of this project was to assess soil biodiversity in areas impacted by controlled burns, and to analyze the effects these have on soil biodiversity, immediately and over time. To assess this, soil samples were taken from several different sites that received 5 different treatments, the primary variable measured being year of burn, the control being unburned. These samples were extracted using the Berlese funnel method and then identified by taxonomic group and quantified. Our primary results indicated that sites burned 10 or more years ago have significantly higher biodiversity than more recently burned areas. Taxonomic groups also varied in response to burns with some increasing in relative abundance and others decreasing. These findings can inform management decisions for controlled burns.

44 - Bugs by the Bay!: Diversity Patterns of Coastal Alabama's Stream Insects

Carlos Sankone, John McCreadie

University of South Alabama, Mobile, AL

It is no secret that we are currently facing a crisis of global diversity loss. Among the most threatened taxa are insects, which have shown stark declines and are expected to be 40% extinct by the end of the century. But how has insect diversity fared within historically diverse regions such as the coastal streams that flow into America's Amazon – the Mobile Tensaw Delta? Biodiversity within these regions can be measured using various indices of beta (β)-diversity. β-diversity is a calculated measurement that addresses changes in diversity across different assemblages within a specific region. Studies of β-diversity often address changes in diversity across gradients of environmental conditions and distance among sites. However, β-diversity of stream insects can be difficult to measure due to their hyper-diversity and challenging taxonomy. Our study investigated the association of β-diversity, calculated using Sørensen's index, with habitat conditions and distance among habitats for insects found in the coastal streams of Alabama. Additionally, we looked for potential influences caused by seasonality (fall, summer) and the level of taxonomic identification (genus, species). Regardless of season, stream conditions were highly correlated with β-diversity. More specifically, stream size and water chemistry showed the highest associations with β-diversity. Changes in β-diversity were largely driven by species turnover rather than species nestedness. Taxonomic resolution had minimal effects on the calculations of β-diversity across environmental conditions. Distance among stream sites was never correlated with β-diversity. As we continue to face global insect declines, our study provides valuable insight into the patterns

that drive changes in diversity across environmental gradients, but there is still more work to be done to understand the specific impacts and extent of these environmental changes over time. We now look to address the impacts of stream conditions on coastal Alabama's insect diversity across both spatial and temporal scales.

45 - The body size, body composition, and cellular immune response of mosquitoes are shaped by the individual and interactive effects of warmer temperatures and aging

Saksham Saksena, Jordyn Barr, Julian Hillyer

Vanderbilt University, Nashville, TN

Many factors, including environmental temperature and aging, shape how mosquitoes develop, metabolize nutrients, and respond to infection. Mosquitoes are poikilothermic ectotherms, meaning that their body temperature, which dictates the efficacy of many physiological processes, depends on the temperature of their environment. As mosquitoes age, they undergo senescence, which is characterized by decreased metabolic rate, body deterioration, and weakening of immune prowess. Individually, both factors shape mosquito physiology, but it is unknown how temperature alters the rate of senescence. Therefore, we investigated how warmer temperature and older age interact to shape the body size, body composition, and cellular immune response of the societally important mosquito, Anopheles gambiae. For the body size and composition, we took a multipronged approach and measured the abdomen, tibia, and wing lengths, dry weight, and the carbohydrate, lipid, and protein content in naïve mosquitoes reared at 27°C, 30°C, and 32°C at 1-, 5-, 10-, and 15-days post eclosion. We found that warmer temperatures resulted in marginally smaller mosquitoes. Abdomen length, dry weight, and lipid content changed with aging, initially increasing, and then decreasing with advanced age. Carbohydrate content increased with aging, whereas protein content decreased with both warming temperatures and aging. Additionally, the interaction between temperature and age significantly affected protein content, causing it to decline at a faster rate in warmer temperatures. This suggests that temperature and age may interact to shape other facets of mosquito physiology, including the immune response. For the cellular immune response, we have quantified the number of sessile hemocytes along the dorsal abdomen in naïve and infected mosquitoes of the same temperature and age groups listed above. Preliminary analysis has revealed significant effects of infection, temperature, age, and the interaction between temperature and age on the number of sessile hemocytes available to fight an infection.

46 - Impact of Chondronema passali on the cold tolerance of horned passalus beetles

Wesley Rhinehart[1], Leigh Boardman[2]

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Temperature impacts all organisms, particularly ectotherms like insects. To better understand how an organism responds in its natural environment, it is important to study the effect of multiple simultaneous stressors. Two commonly coinciding stressors in insects are low temperatures and immune challenge. These stressors may activate similar mechanisms, resulting in cross-talk. In this study, we utilize horned passalus beetle, *Odontotaenius disjunctus* (Illiger) and nematode (*Chondronema passali*) that live in their hemocoel, to study whether cold tolerance and immune function are correlated. Previous research has shown that the number of nematodes in a beetle can alter performance and physiological metrics. We hypothesized that higher loads of nematodes would increase cold tolerance in *O. disjunctus.* Adult beetles were collected from Overton Park and the University of Memphis Meeman Biological Station, Memphis, TN and kept in the lab at ~24°C for 3 days before they were massed and used for either chill coma recovery time (CCRT) or supercooling point (SCP) assays (minimum n = 20 per site per assay). CCRT measures the time required for an insect to regain muscular control from chill coma, while SCP is the temperature at which ice forms inside the body of an insect. After cold tolerance assays, beetles were dissected to determine sex, and the number of nematodes present in their hemocoel were counted. The average CCRT was 739±19.4s (n=41) and the average SCP was -4.20±0.239°C (n=41). Based on nematode counts to date, there is no correlation between nematode load and CCRT ($R^2 = 0.0869$) or SCP ($R^2 = 0.0042$). This study will bolster the preexisting thermal tolerance literature on *O. disjunctus* and will facilitate further multiple stress studies in this system.

47 - Impact of different insect diets on Costa Rican Zebra Knee Tarantula (Aphonopelma seemanni) growth

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Tarantulas are opportunistic insectivores with dietary impacts on growth being largely unknown. Tarantulas in human care are predominantly fed a homozygous diet with dietary variation being used as enrichment. While male tarantulas sexually mature after their final molt, females can take up to eight years to mature. Difference in maturation rate facilitates a slow population recruitment. This study used Costa Rican Zebra Knee Tarantulas (Aphonopelma seemanni) as a model organism to benefit the conservation of tarantulas by comparing diets to the growth of juvenile tarantulas. Quicker growth may mean quicker reproduction which will decrease the need for wild-caught specimens in scientific studies and arachnoculture. In this study, 8 juvenile (sling) A. seemanni were split into 4 pairs. Each pair were fed an equal mass of crickets (Acheta domestica), mealworms (Tenebrio molitor larvae), dubia roaches (Blaptica dubia) or a rotation between all 3. Growth was tracked through tarantula weights and molting frequency. After 12 months, the slings fed exclusively mealworms were visually obese, being on average 74% heavier than the other three pairs. However, there was little variation in molting frequencies. Heavier tarantulas do not necessarily mean healthier tarantulas. Obesity concerns in the mealworm group resulted in a study-wide temporary fast for their well-being. Complete growth rates are ascertained at maturity; therefore this study is still ongoing. Thus, the information gathered can be used to establish a baseline for future studies on the impacts of tarantula growth rate on fecundity to benefit conservation and arachnoculture.

48 - Parasite Hideouts: Choosing Careful Nest Materials in Bee Hotels for Preserving Native Bees

Bailey Lankford, Maria Escobedo, Camila Filgueiras

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Native bees and wasps are essential to ecosystems across the United States, including North Carolina. Populations of these insects are at risk from several factors, including pesticide usage, climate change, and habitat destruction. Providing habitat for native Hymenopterans is an important step in preserving their populations. Bee hotels, such as those on the University of North Carolina at Asheville and North Carolina State University campuses, provide a safe, protected space with a variety of nesting materials suited for many species of native bees that live in the area. However, due to the concentrated nature of these hotels, they can also attract many different species of parasites. These parasites can easily remain in the bee hotels and multiply if the hotels are not regularly cleaned and maintained. The parasites attack overwintering bees and bee eggs, and can quickly affect the population makeup and efficacy of the hotels that they infest. Bee hotels are usually filled with a variety of different materials, including rolled cardboard tubes, reeds, bamboo, wooden blocks or logs, and native plant stems. In order to infest the hotel, the parasites must be able to access the overwintering bees or bee eggs through the nesting materials. This study, which spanned two years, seeks to determine whether any of the materials commonly used for bee hotels are more or less prone to parasitic infestation. We observed that cardboard tubes were more susceptible to parsitic infection than other materials. If certain material types are easier for parasites to access, then removal of these materials, coupled with regular maintenance, might provide the bees with nesting habitat that is less susceptible to parasitism and therefore safer. This data will provide guidance for bee hotel builders to select nest materials that safeguard the bees, leading to overall enhancement of the surrounding ecosystem.

49 - Cryptosporidium Infection in Cattle based on Water Source, Age, and Gender

Lauryn Faulkner-Sitton

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In all parts of the world, Cryptosporidium has been known to affect dairy, meat, and pet cattle, all of which have various living conditions. Cryptosporidium is a parasitic water-borne protist which affects most animals, including humans. Symptoms that occur when an individual is infected are diarrhea, lethargy, growth defects, and even death. The main environmental factors being taken into consideration in this paper are age, gender, and type of water source the cattle have access to in their given pasture. Samples from cattle of different ages and genders were collected and tested for the presence of Cryptosporidium, using a modified Zeil-Neelsen fast acid staining procedure. The number of Cryptosporidium per 0.01g of fecal matter was counted for each individual. Once all data had been recorded, the amount of shed oocysts per individual was compared to the type of water source the individual has access to, as well as the gender and age of the individual. In analyzing the data, cattle with access to creeks had overall higher rates of infection compared to the cattle with access to only troughs. Calves, or cattle under six months old that were nursing on cows had significantly lower rates of infection while calves that were no longer nursing had significantly higher rates of infection compared to adult cattle. These results now provide knowledge into possibly reducing the infection rates of Cryptosporidium in cattle by changing the type of water source they have access to, and by taking extra precautions during certain ages of the cattle.

50 - The fitness consequences of Wolbachia infection in the parasitoid wasp Trichogramma kaykai.

James E Russell, Nawal Khader

Georgia Gwinnett College, Lawrenceville, GA

Wolbachia pipientis is considered the most pervasive bacterial infection in the animal kingdom. The two most speciose and abundant animal taxa in the world, Insecta and Nematoda, are the primary reservoirs for Wolbachia, with estimates of over 50% of all insects infected. As a maternally inherited bacterium with significant fitness consequences, Wolbachia has the potential to impact the evolution and ecology of infected species. The Molecular Ecology Laboratory at Georgia Gwinnett College has conducted a long-term experiment with Wolbachia infection among Trichogramma kaykai wasps. Infection among T. kaykai wasps results in the feminization of males and the ability of females to clone themselves (thelytoky), a process referred to as parthenogenesis-induction (PI). Most species infected with PI Wolbachia have no, or very low frequencies of, males, are obligately clonal, and dependent on Wolbachia for reproductive survival. T. kaykai is a parasitoid with one of the only known PI Wolbachia infections that can be cured and can reproduce sexually. Using these unique features, we conducted a series of curing and mating experiments to address ecological questions related to the fitness cost associated with infection, and evolutionary questions related to the impact of genetic variation in sexual and asexual populations. Our preliminary results suggest Wolbachia has significant detrimental fitness effects on T. kaykai. We will also discuss preliminary findings of introduced genetic variation among asexual and sexual T. kaykai populations.

51 - Wild ramp visitors: Assessing the arthropod community of an emblematic Appalachian species using eDNA

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Ramps (*Allium tricoccum* Ait.) are popular spring ephemerals in Eastern North America due to their pungent, garlicky taste. Despite their popularity, little is known about their life-history traits, including what insects visit and potentially pollinate their flowers. Monitoring communities of arthropods is challenging, mainly because they are time-consuming and highly dependent on taxonomic expertise. Environmental DNA (eDNA) metabarcoding allows for faster and non-lethal surveys of these communities as it amplifies the traces of DNA left by arthropods when visiting the plants. For this study, we collected 48 ramp umbels in two localities, Grafton WV,

and Bolivar PA, in the summers of 2021 and 2023. We performed eDNA barcoding on these samples using the universal animal barcode, the cytochrome c oxidase subunit I (COI). We obtained eDNA representing 18 arthropod orders, including 83 families, and 90 genera, from different ecological groups such as pollinators, predators, parasitoids, and phytophagous species. Overall, our study shows eDNA as a viable and valuable tool to assess arthropod communities of wildflowers and provides information on the life-history traits of an emblematic species in Appalachian culture.

52 - The Effects of Urbanization on Disease Prevalence in Managed Honey Bee Hives in Hamilton County, Tennessee

Prof. Caitlin Jarvis, MS[1], DeAnna Beasley[2]

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Rapid urban development may increase stress and disease exposure on economically essential organisms, including honey bees. We surveyed 18 apiaries containing 53 hives for diseases and productivity from 2021-2022 in Hamilton County, Tennessee at varying levels of urbanization. Disease levels were analyzed at 1.0 km intervals from 0.5-9.5 km radii from each hive. *Varroa* levels significantly decreased with increased urbanization. There was a weak negative correlation between *Varroa* load and the likelihood of surviving the study. There was a positive relationship between urbanization and small hive beetle count. A positive relationship existed between small hive beetle counts and increased urbanization. This is significant as it indicates a changing disease ecology based on the degree of urbanization. As both urbanization and the demand for pollination services increase, it is vital to understand how honey bees will adapt to changing environments and pressures.

53 - Allometry and Sexual Dimorphism of Sensory Structures in Cambarus carinirostris

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This project sought to study the allometry of the sensory structures of *Cambarus carinirostris* and determine the presence of sexual dimorphism in these structures. *C. carinirostris*'s aquatic lifestyle forces them to rely on mechano- and chemoreception rather than auditory and visual input. The antennae and antennules were found to increase steadily in length with increasing carapace length; there was no statistically significant evidence to support sexual dimorphism in these structures. Fan organs were also found to increase steadily in length with increasing carapace length, but the fan organs of male crayfish were found to start smaller and grow larger than those of female crayfish. Sexual dimorphism may occur in the fan organs because male crayfish fight each other for mating opportunities and use chemical signals in their urine to help establish dominance. In the future, this project will continue by collecting the same measurements from the following species: *Faxonius obscurus*, which is found in the same environment as *C. carinirostris*, and *C. monongalensis*, which is a primary burrowing species found in the same range. After these three species have been studied, measurements can be taken from species that live in other environments and compared to the crayfish phylogeny to determine how environmental conditions affect morphology of sensory structures.

54 - Over My Dead Body: The Case of the Woman in the Basement

Dr. Ed Mondor, BSc, MSc, PhD

Georgia Southern University, Statesboro, GA

As the only forensic entomologist in the state of Georgia, my lab routinely assists law enforcement with death investigations to develop minimum postmortem interval (i.e., "time of death") estimates for human decedents. Here, I will discuss my role as a forensic entomologist in a case of elder abuse from North Georgia. I will describe the methodology used to determine the insect species involved, how those insects were related to the condition of the deceased individual, and how insect development provided essential information to this case. This talk will also provide a better understanding of the role of a forensic entomologist in criminal investigations.

55 - Low temperature tolerance of kudzu bug, Megacopta cribraria

Mitchell Adkins[1], Leigh Boardman[2]

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Kudzu bug, *Megacopta cribraria*, is native to various countries in Asia. It was first detected in USA in a suburb of Atlanta, Georgia in 2009, and is currently found across the southeastern USA. These insects have an oviposition preference for kudzu (*Pueraria montana*), but can oviposit on other legumes such as soybean. The USA is one of the largest producers of soybean oil across the globe and this insect can threaten this resource. Understanding the thermal tolerance of invasive insects can assist in predicting potential spread and environmental impacts. Previous research on cold tolerance of kudzu bug in the USA focused on populations in Virginia and Maryland. For this study, we investigated a population of kudzu bug in western Tennessee to compare their cold tolerance to those found further north. Approximately every month, adult kudzu bugs were collected off kudzu at University of Memphis Meeman Biological Station. Insects were kept at ~25°C in the lab and separated into two groups: fasted and fed (access to kudzu leaves ad libitum). For each group two assays of cold tolerance were measured after bugs were weighed and sexed: chill coma recovery time (CCRT, recovery from cold exposure) and supercooling point (SCP, freezing temperature). Kudzu bugs recovered from chill coma slower in September (621±27.1s, n=26), than December (521±15.4s, n=39). The collective average SCP of all kudzu bugs in September was -14.6 ± 0.3°C, (n=32) while in December it was -6.7 ± 0.1°C, (n=64). The September SCP data closely resembled previous data from more northern populations. Interesting results on the effects of feeding status and sex on cold tolerance were found. Our results clearly show seasonal plasticity in cold tolerance of kudzu bugs in west Tennessee, with overwintering adults recovering faster from a cold exposure.

56 - Host sharing of ectoparasitic lice in flamingos at the Memphis Zoo

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Samples of ectoparasites obtained from zoo animals are typically not used for studies on host associations or parasite diversity. Animals that do not typically live in the same areas in the wild can be housed in proximity, which can enable sharing of parasites. Establishing host associations and parasite diversity from zoos can therefore be misleading. On the other hand, studying parasites from zoo animals provides a unique opportunity to test how human actions can facilitate the exchange of parasites between different host species and whether host specific parasites will move to a similar host if given an opportunity. Here, we use genetic information to investigate ectoparasitic lice from a Lesser Flamingo (*Phoeniconaias minor*) at the Memphis Zoo. Both Lesser and Chilean Flamingos (*Phoenicopterus chilensis*) are kept in a single enclosure at the zoo, despite the two species having native ranges on different continents (Africa and South America, respectively) and are separated by ~7 million years. We sequence whole genomes from two individual lice and a mitochondrial gene from nine individual lice from the zoo Lesser Flamingo. We then compared the DNA sequences to data from lice form wild Lesser and Chilean Flamingos. We found strong evidence that all of the lice from the zoo Lesser Flamingo are Chilean Flamingo lice. Both mitochondrial and nuclear data grouped the zoo lice with wild Chilean lice, considerably separated from the wild Lesser Flamingo lice. We also compared the entire mitochondrial genomes (mitogenomes) from representative lice and found that the mitogenomes from zoo Lesser Flamingo lice and wild Chilean Flamingo lice are identical but had several major differences in gene order compared to lice from wild Lesser Flamingo. Together, our results strongly support that human activity has facilitate the sharing of ectoparasites in two species that are typically separated by geographic space and time.

57 - Syrphidae of the Southern Appalachians: Diversity, Floral Associations, and Foraging Behaviors

PJ Coleman

Appalachian State University, Boone, NC

Flies of the family *Syrphidae* (hoverflies) are a widespread and diverse group of dipterans consisting of over 6000 species worldwide. Although most of the buzz surrounds bees, Syrphid Flies are thought to be equally important pollinators of native plants; however, studies exploring their diversity, distribution, and efficacy as pollinators are lacking. My research seeks to describe the diversity and distribution of Syrphid Flies in the Southern Appalachians along the Blue Ridge Parkway, as well as explore aspects of their foraging behavior relevant to their pollination services.

Syrphid Flies were collected through passive trapping (2019, 2020) and active netting (2021-23) at 100 sites alongside the Blue Ridge Parkway in North Carolina and Virginia. Analysis of specimens from the surveys revealed over 80 species of Syrphid along nearly 500 miles of roadway. These occurrence records will be used to create park-wide habitat suitability models using MAXENT. I also assessed floral associations and floral species fidelity during foraging bouts of two Syrphid species, *E. Transversa* and *S. Ribesii* (N=20/species), as they encountered a variety of local flora. Gaining a baseline understanding of hoverflies and their potential as pollinators may prove beneficial in supporting pollination services throughout natural, recreational, and agricultural assets, particularly as many other native pollinator species begin to experience declines in abundance.

58 - Interaction study of the developmental effects of sodium fluoride and sodium selenate on Xenopus laevis embryos

Shelby Wolfram, James Rayburn, Grover Brown, Michael Burns

Jacksonville State University, Jacksonville, AL

Amphibians play critical roles in the environment's wellness. Fluoride (F) is a widely existing environmental pollutant. It is commonly known for being added to drinking water and as a topical dose on teeth. Selenium (Se) can be found in organic and inorganic forms in nature. The range selenium has between deficiency and toxicity is narrow, meaning excess exposure could cause various adverse effects in aquatic organisms. *Xenopus laevis* is a standard model for developmental toxicity due to being minimal maintenance, cost efficient, and having transparent embryos. *Xenopus* makes an acceptable model for estimating the developmental effects of chemicals on native amphibians. The objective in this study is to determine the interactions effects on developmental toxicity of Sodium Fluoride, Sodium selenate, and 3 mixtures combinations on amphibian embryos. The assay uses serial dilutions to expose various concentrations to frog embryos. The assay lasts 96-hours holding 20 embryos in small petri dishes per replicate. Mortalities were counted for each day. Mortalities and malformations were counted on the last day of the assay and embryo length were measured. Means, standard error, probit analysis (LC50 and EC50(malformation)), ANOVA and Bonferroni's post hoc test were calculated using Systat. The teratogenic potential was calculated using the formula LC50/ EC50(malformation). Isobole diagrams were used to determine if the chemicals showed synergism, antagonism, response addition, or concentration response. The overall LC50, EC50 for F and Se was 603.37, 819.42 and 30.41, 15.13 respectively. The mixtures showed a combination of response addition and synergism at different combinations. Malformations such as stunted growth, edemas, loose gut, hemorrhages, bent notochords, and kinked tails were seen in both Selenate, fluoride, and mixtures. Overall, this are in agreement with a similar study with *Ambystoma* embryos. Overall, these assays show the usefulness of the *Xenopus* embryos as model species for native amphibians.

59 - Measuring spatial and temporal variation in species composition of ephemeral pond amphibian assemblages using metabarcoding

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Metabarcoding utilizes environmental DNA (eDNA) shed by living organisms to screen for diagnostic DNA sequences and survey biodiversity. Metabarcoding allows for the simultaneous detection of many related species at once based on sequence comparison using phylogenetic inference. Global amphibian populations are at risk of reduction or extinction, therefore efficient and accurate surveying methods are of great importance to informing conservation efforts. We have tested the tools required for amphibian metabarcoding in the southeast US and implemented a comparative study that examines the utility of metabarcoding in lieu of traditional visual encounter surveys and the ability of metabarcoding to measure temporal variation in the composition of pond-breeding amphibian assemblages. In visual encounter surveys of eight sites over five sampling intervals, we found 14 species of amphibians, with the faunal assemblage across sites varying spatially and temporally. Pond water collected at each site was filtered for genetic material, yielding 33 eDNA samples for metabarcoding. We tested a previously developed mitochondrial ribosomal RNA gene (12S rRNA) assay for performance across southeastern amphibians. In silico and in vitro analyses revealed that this assay will amplify 32 common southeastern amphibians, giving great confidence in this assay's ability to reliably amplify amphibians across the southeast. Initial PCR tests on DNA extracted from both tissue samples and water samples revealed successful amplification of the target region. Development of a reliable metabarcoding strategy will improve our ability to efficiently and rapidly assess amphibian assemblages at ephemeral pools compared to traditional methods. Knowledge of breeding pond phenology is useful to conservation initiatives focusing on reducing disturbance to amphibians during prime breeding seasons across a multitude of species and locations.

60 - The preliminary developmental effects of Cannabidiol (CBD) on embryos of Xenopus laevis.

James Rayburn, Markisha Clayton

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Cannabidiol (CBD) is a non-psychotomimetic compound found in *Cannabis sativa* that has medicinal potential. CBD has been used to treat epilepsy as well as other diseases of the nervous system. Recently CBD has been the subject of research, including its applications in cancer therapy. An important gap in determining the safe levels of CBD intake is determination of CBD's potential to cause reproductive or developmental toxicity. *Xenopus laevis* (African clawed frog) is an animal model useful in determining developmental effects to vertebrate species. The Frog Embryo Teratogenicity Assay (FETAX) has also shown to be predictive of human teratogenicity. The frog model has numerous advantages including fast reproduction, transparency body as a tadpole, relatively large size of stages and being a tetrapod. Numerous studies have been done in validation and used for predictive developmental effects of chemicals and mixtures using Xenopus embryos. The objectives of this study were to determine the LC50, EC50 (malformation) and the minimum concentration to inhibit growth (MCIG). Early-stage embryos (blastula stage) are exposed for 96-hours with static renewal every 24 hours. Every 24 hours mortality was assessed and at 96 hours mortality, malformation and embryo length were determined for each test solution. A carrier solvent DMSO was used as water solubility of CBD was very low. Probit analysis from Systat was used to determine the LC50 and EC50 values and ANOVA and Bonferroni post hoc test was used to determine MCIG. The LC50 divided by the EC50 (malformation) gives a teratogen index (TI) which indicates the risk a chemical or mixture may pose. The preliminary results show an LC50 of approximately 2 mg/L and EC50 of 1.5 mg/L yielded TI of about 1.3. Significant malformations were seen at concentrations of 1.25 mg/L. These results indicated further testing is needed to determine potential teratogenic risk of CBD.

61 - Dynamics of skin-based gene expression in red-sided garter snakes (Thamnophis sirtalis parietalis): sex and seasonal influences

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The skin is the key organ regulating the animal-environment interface and is particularly sensitive to the abiotic factors of temperate environments, such as extreme cold and aridity during winter. Previous research found that, in the skin, temperate birds and reptiles upregulate expression of lipid synthesis genes to prevent tissue freezing and evaporative water loss in winter. Our study species, the red-sided garter snake (*Thamnophis sirtalis parietalis*), has seasonally variable skin lipid composition, and females produce a modified set of these lipids that function as a sex pheromone. The pheromone is maximally produced in the spring breeding season following prolonged, low-temperature dormancy (~8 months at 2-4°C). Also, at least one tissue in this species has temperature-sensitive gene expression (sex regions of the brain), which implies similar sensitivities in gene expression exist in other tissues associated with reproduction, such as skin. Production and modification of skin lipids in vertebrates is achieved by a series of enzymes, yet much remains elusive regarding seasonal and sexual variation in said gene expression. We investigated the influence of sex and season on expression of lipid synthases (ACAC, FASN, ELOVL1) and desaturases (FADS1, SCD) in the skin of male and female red-sided garter snakes across their active period (spring, summer, fall) using quantitative PCR. Overall expression in both sexes was high in spring and suppressed in summer. Upregulation occurred in males in fall, seemingly responding to cooling, whereas females did not. Additionally, most genes demonstrated strong co-expression, which may suggest sex-specific pathway dynamics in the skin. Our findings reveal how skin lipid metabolism operates at the molecular level in reptiles, and how it may influence sex-specific reproductive strategies and enable animals to cope with climate change.

62 - Members of the Board: An Update on Long-term Study of Coverboards at Georgia Gwinnett College

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Coverboards are an easy, common field technique that can be used to observe and analyze organismal communities. Georgia Gwinnett College, located in Metro Atlanta, has an ongoing coverboard study to determine which species are present in our campus woods, as well as the seasonal changes in the organismal communities. We have two parallel transects of boards starting from a powerline cut on a hill and extending northwest and downslope towards the Yellow River. Each transect has ten sets of coverboards, each set consisting

of a small, medium, and large piece of plywood. Boards are checked once a month and the types of animals underneath are recorded. We have observed a noticeable trend between the season and the presence of snakes and salamanders. Snakes tend to be present in the warmer months and salamanders present in the colder months, and it is uncommon that both are found under the same board at the same time. These and other patterns will be discussed.

63 - Marbled Salamander Population Dynamics in Catawba College's Ecological Preserve

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Marbled Salamander Population Dynamics in Catawba College's Ecological Preserve

The marbled salamander (Ambystoma opacum) is a keystone predator in the seasonal ephemeral ponds they inhabit, emphasizing the significance of understanding their population dynamics and habitat preferences for scientific inquiry and comprehension of vernal pools. This research project centers on assessing and comprehending the population density and distribution of marbled salamanders within Catawba College's Fred Stanback Ecological Preserve. Targeting four distinct wetland types within the preserve, we collect data on salamander sex, size, identity, and location to gain insights into their spatial ecology. Our methodology involves systematic surveys and data collection during the breeding season to accurately capture salamander presence and abundance. In addition to adult marbled salamanders, our study incorporates observations of marbled salamander larvae in vernal pools, providing crucial insights into their population dynamics. Furthermore, we explore the behaviors of spotted salamanders during their breeding season, contributing a holistic perspective to our investigation.

Utilizing GIS (Geographic Information Systems) programs, we analyze and visualize the collected data, creating detailed maps illustrating the distribution patterns of marbled salamanders across the four wetland types. An innovative aspect of our approach is integrating the I3S Pattern Identification program, assigning unique ID numbers to individual salamanders based on photographs. This program enables efficient recapture identification, allowing us to track individual salamanders and analyze their movements and site fidelity over time.

This research extends beyond the study of adult marbled salamanders, incorporating observations of larvae and behaviors of spotted salamanders, thus providing comprehensive insights into the natural behaviors and spatial ecology of marbled salamanders. Ultimately, our work represents the integration of field studies with GIS and the I3S Pattern Identification program to explore the population dynamics of this species, enhancing our understanding of how marbled salamanders interact with their habitat.

64 - The Effects of Soil Moisture on Entomopathogenic Nematode Behavior

Dana Frankenstein[1], Macawan Luu[2], Jennifer Luna Ayala[3], Denis Willett[4], Camila Filgueiras[3]

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A changing climate can disrupt biotic interactions between plants, insects and soil microorganisms. Many of these belowground interactions are mediated by volatile organic compounds (VOCs) which can be used for communication under appropriate environmental conditions. Behavioral responses to these compounds may be dependent on varying soil conditions which are projected to be influenced by a changing climate. To determine how changing environmental conditions may affect VOC-mediated biotic interactions, we used a belowground system where entomopathogenic nematodes (EPNs) - tiny roundworm parasitoids of insect larvae - respond to VOCs by moving through the soil pore matrix. Specifically, we used two genera of EPNs - *Heterorhabditis* and *Steinernema* - that are known to respond to three specific terpenes - α-pinene, linalool, and d-limonene - released by the roots of plants in the presence of herbivores. We assessed the response of these nematodes to these terpenes under three moisture regimes to determine whether drier or inundative conditions may influence the behavioral response of these nematodes. Our results illustrate that the recovery rate of EPNs is positively associated with soil moisture concentration, demonstrating that soil moisture influences EPN host-seeking behavior. As climate change alters soil moisture conditions in variable ways, EPN efficacy as biological control agents will likely be affected significantly. Therefore, we expect future utilization of entomopathogenic nematodes in agricultural settings to be most effective under consideration of current and future abiotic soil conditions.

65 - Context-dependent Costs and Benefits to Cowbird Parasitism in Prothonotary Warblers

Rin Pell, Kelly O'Neil, Kelly Miller, Ashley Atkins-Coleman, Shelby Green, Madison Mash, E. Keith Bowers

University of Memphis, Memphis, TN

The coevolutionary arms race between hosts and parasites is often portrayed as two opposing forces locked in an ongoing battle of alternating selective advantages, but this model may fail to capture the full and complex nature of these multispecies interactions. For example, hosts of a generalist brood parasite, the brown-headed cowbird (*Molothrus ater*), generally experience greater nestling mortality, higher instances of nest failure, and lower pre-fledging mass of host nestlings compared with unparasitized conspecifics, yet many hosts continue to accept and rear brood-parasitic young. While understanding the singular effect of parasite nestlings on the consequences for host fitness has shed important light on the natural history of these systems, brood parasitism does not exist within a vacuum. In a complex environment, the pressures shaping host decisions as to accept or reject a brood parasite may not be so simple. Here, we investigate whether accepting and rearing brood-parasitic cowbird young confers context-dependent benefits of fostering parasitic nestlings by mitigating the deleterious impacts of another common avian parasite: hematophagous blowfly larvae (*Protocalliphora deceptor*). We experimentally eradicated blowfly larvae in prothonotary warbler (*Protonotaria citrea*) nests that

naturally contained or lacked a cowbird nestling and recorded morphometric measurements, hematocrit, and host fledging success. In following seasons, we also recaptured adults and documented the recruitment of offspring into the local breeding population. Our data revealed that strongly negative effects of cowbird parasitism only occurred when combined with the presence of ectoparasitic blowflies. Furthermore, even though cowbird-parasitized nests fledged fewer host young, these warbler nestlings raised alongside cowbirds were more likely to recruit and breed as adults the following year, suggesting positive effects of cowbird parasitism on host fitness. Overall, we show that the coevolutionary arms race is complicated by interactions between multiple parasites, which may help explain the evolutionary maintenance of brood-parasite acceptance.

66 - Cheaper by the dozen? Effects of brood size on provisioning dynamics and parent-offspring conflict in a wild songbird

Kelly O'Neil, Kelly Miller, Rin Pell, Ph.D. student, Shelby Green, Madison Mash, E. Keith Bowers

University of Memphis, Memphis, TN

The number of dependent young for which parents simultaneously provide care may affect how this care is distributed among them depending on both parent and offspring interests, which may be cooperative or conflicting. Classic research in avian family dynamics suggests that offspring with more siblings should encounter a higher degree of sibling competition than those with fewer siblings, and that parental favoritism is often directed toward larger offspring. However, recent observations of wild prothonotary warblers (Protonotaria citrea), a species that exhibits within-individual variation in brood size, suggest that parents favor larger young within small broods, but smaller young within large broods. To further investigate this pattern, we manipulated brood size in wild prothonotary warblers by cross-fostering different numbers of nestlings between broods of the same age, thus experimentally reducing or enlarging broods within an ecologically relevant range. For controls, we cross-fostered the same number of nestlings from each brood. We filmed nests during two developmental stages and used an intricate scoring protocol to quantify nuanced parent and nestling behaviors during individual feeding events. With these data, we will elucidate the factors influencing food distribution and make causal inferences about the role of brood size, helping to resolve conflicting hypotheses about the nature of parental responses to nestling signals. Further, we will discuss the adaptive potential of within-individual variation in brood sizes.

67 - Bringing the effects of artificial illumination on mammal diel activity patterns to light

Sam Williams, Emily Prince, Kerry Hansknecht, Lisa McDonald

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Artificial light at night (ALAN) is an increasing source of anthropogenic pollution associated with changes in animal foraging behavior, migration patterns, and vigilance. We previously found mammals in sites with high ALAN have different diel activity patterns than those in sites with low ALAN. But, because ALAN is associated with urban environments, we could not separate the effects of ALAN from the effects of other human infrastructure. To determine the effects of ALAN on mammal diel activity, we directly manipulated ALAN levels at camera-trap stations illuminated by white, red, or no light. We hypothesized that all mammals would shift towards a more diurnal activity pattern to avoid ALAN, and that white light would have a greater effect than red light. We compared the number of diurnal and nocturnal observations of all mammals between stations with white lights, red lights, and no lights. We then conducted the same analysis three more times for observations of deer, gray squirrels, and raccoons. As hypothesized, a higher proportion of mammal observations occurred during the day at stations with ALAN present, and white light had a greater effect than red light. Deer exhibited a diurnal activity pattern at all stations, but the proportion of daytime observations was higher at stations with any ALAN present. As with all mammals, white light had a greater effect than red light on deer. In contrast to our hypotheses, ALAN had no effect at all on squirrels or raccoons. Overall, ALAN, apart from other types of human infrastructure, does affect mammal diel activity, but the effects are species-specific. The effects of ALAN can be partially mitigated by using red lights rather than white lights.

68 - The evolution of arthropod reaction to the presence of smoke

Adam Miles, Albert Meier

Western Kentucky University, Bowling Green, KY

Many animals have a survival instinct to flee in response to fire, but do they respond to smoke? Many arthropods are known to respond to fire by moving in the opposite direction (negative response) from a fire or to find shelter. The response behavior has been observed in some terrestrial arthropods, but currently this behavior is unknown for marine, aquatic, or cave arthropods, which are atypically exposed to smoke or fire. My research proposes to investigate the behavioral response to smoke of arthropods by comparing responses by aquatic, terrestrial and marine arthropods. I will be assessing arthopods that currently live in a different system than their ancestors. These different groups of arthropods may have retained the behavior of negative response with respect to fire or smoke. Through experimental approaches, I will test whether aquatic arthropods derived from terrestrial arthropods have retained, lost, or gained this behavior. I put the individuals into a plastic testing arena and introduced smoke (with a bee smoker) for 30 seconds and recorded the individual's movement using software and time to quantify the effect. Independent t-tests were used to analyze the difference between individuals for control and experimental observations. Additionally, PCA will be used to compare the movements of organisms found in different environments. There were 22 different arthropod orders used in this study. The results of a pairwise t-test, conducted on control and experimental data on the same individuals in each order, showed that six different orders had a significant difference between the mean time of movement in the control trial, compared to the experimental trial with a Bonferroni correction test. There were three arthropod orders that had a significant difference between the mean time of movement in the control trial, compared to the experimental trail (without the Bonferroni correction).

69 - Comparative studies on mammalian social organization must rely on high quality data and account for intraspecific variation

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Comparative studies on birds and mammals have generated excitement about the origins and evolution of group living and cooperation. Notable hypotheses generated by these studies is the ancestral social organization of many taxa is solitary or pair-living and cooperative breeding (a form of group-living) likely evolved in harsh environments. Many of these studies have been published in high impact journals and have informed emergent social evolution theory. Some of these studies have suffered from methodological limitations, relied on datasets based on taxonomic inference, and have ignored crucial variables, such as intraspecific variation in social organization (IVSO). To enhance theory, comparative studies need to rely on datasets based on high quality natural history data and remain free of assumptions. For example, while the social organization for most mammals was believed to solitary living, recent evidence indicates that only 22% of species are solitary. Since 2015, we have been building a dataset on mammalian social organization based on the primary literature and not assumptions. We have shown that IVSO is ubiquitous and thus, cannot be ignored in comparative analyses. We have developed multi-level phylogenetic models with a flexible Bayesian framework to investigate the evolution of social organization in several mammalian orders, including primates. Consistently, our analyses indicate that accounting for IVSO changes the story about the evolution of social organization and thus, challenges theory based on previous studies. The aims of this talk are to (i) introduce the concept of IVSO and why it is important to understanding social complexity, (ii) discuss our process of data collection, with an emphasis on data quality and consistency, and (iii) highlight exciting trends in artiodactyls and primates from our work. We hope that our presentation stimulates a productive conversation about the need for rigorous, standardized methods in comparative studies. Funded by NSF OISE 1854177.

70 - How can acoustics and soundscapes inform our understanding of biology and conservation

Dr. John Quinn

Furman University, Greenville, SC

Acoustic indices have been used to assess biodiversity in a variety of ecosystems, but their relationship to traditional measures of biodiversity, such as richness and occupancy, is not well understood. In this study, we used data collected from automated recording units on 135 farms across North America to investigate the relationship between indices and measures of biodiversity. We found that while select common species frequently correlated with specific indices (e.g. ACI) there were few consistent patterns between acoustic indices and richness or occupancy, within and across sites. This suggests that acoustic indices may not yet be a reliable way to assess biodiversity, at least at a broad species level, in agroecosystems. Further research is needed to understand the factors that influence the relationship between indices and biodiversity including filter, scale, and processing. This research helps improve the use of acoustic indices for assessing biodiversity in a range of ecosystems.

71 - Social Patterns of Polar Bear Family Groups in Late Summer on the Beaufort Sea

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With sea ice loss, an increased proportion of polar bears in the Alaskan Arctic are coming to shore in summer and spending more time on land. The change in habitat use and spatial distribution of polar bears is affecting activity patterns, energy budgets, and intra and interspecific interactions. The behaviors of polar bear mothers with offspring (i.e., family groups) are of special interest because of the energy required for lactating females and their growing offspring. Therefore, our study objective was to determine if family groups behave differently than non-family groups while on land during late summer. We conducted comparative and spatial analyses on family groups and non-family-group bears observed by aircraft during late September 2021 and 2022 along the Beaufort Sea coastline. We compared family group and non-family group behavior (active vs passive) upon aircraft approach and examined their spatial relationships. Preliminary results show that 65% of family groups exhibited active behavior (e.g., walking, running), while 47% of non-family groups were active. We also found that equal proportions of family and non-family groups were found on barrier islands versus the mainland coast. Additional spatial analysis is still in progress, however, we predict that family groups are more likely to be located greater distances from other bears to reduce negative interactions. As polar bears spend more time on land it will be important to track behaviors of different demographic groups, as differences in space use and activity (e.g., energy expenditure) may indicate stress to vulnerable groups (i.e., sows with cubs). Because polar bears are already a threatened species due to habitat loss, it is important to better understand how different demographic groups might respond to future sea ice reductions, especially as it relates to the potential for increased human-polar bear conflict.

72 - Antennae Size Evolution in Crayfish

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Antennae (both the primary antennae and antennules) are the dominant sensory organs throughout crustaceans, providing both chemo- and mechanosensory information about their environments. How these sensory structures have adapted throughout crustaceans remains

unknown. We investigate this question in freshwater crayfishes, which are amongst the most ecologically diverse groups of freshwater crustaceans, inhabiting lentic, lotic, cave, and semi-terrestrial environments. We collected data on the body size, antennae size, and antennule size within over 100 species of crayfish throughout three museum collections. Then, we use phylogenetic methods to explore and explain how ecology and phylogeny relate to antennae size evolution. Our results demonstrate a correlation between habitat and antennae size, but not antennule size.

73 - Assessing depression, anxiety, and stress levels in Biology, other STEM, and Business majors at GGC

Jennifer Regnier, Landy Alvarez, Mark Sweatman, Julia Shearer

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There are increasing worldwide concerns about the mental health of college students. Impaired mental health has been linked to attrition and poor academic performance. The purpose of this study was to identify depression, anxiety, and stress levels in different demographic groups of GGC students. During Spring and Fall 2023, 235 Georgia Gwinnett College (GGC) STEM and business majors were assessed on their levels of depression, anxiety, and stress using the DASS-21. Determining which groups of students suffer from psychological distress can help us develop appropriate assistance programs. Biology and Business were the majors most represented in respondents. Significant differences were found in levels of stress and anxiety according to gender and sexual orientation. Participants who identified as a woman showed significantly higher levels of stress and anxiety compared to those who identified as a man. Bisexuals scored significantly higher levels of anxiety compared to heterosexuals and significantly higher levels of stress compared to both heterosexuals and participants who identified as asexual/non-sexual.

74 - Functional implications of caudal vertebral fusion in mosasaurs (Pythonomorpha: Mosasauroidea)

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Mosasaurs were large-bodied predatory marine squamates, exhibiting a hypocercal caudal morphology rare among extinct and extant vertebrates. Secondary caudal functions, in addition to locomotion, have been ascribed to this anatomy as it pertains to mosasaurs. A high incidence of vertebral fusion has also been noted in their caudal regions since the 1870s. Little research has investigated the etiology of these abnormalities, although most diagnoses have been based on gross anatomy. Those that have examined bone microstructure have suggested etiologies such as avascular necrosis and healed injury, albeit on those specimens with clear gross signs of injury/pathology.

Alabama is rich in Cretaceous marine fossils, with at least 1,300 individual specimens collected to date. In this study, we test three hypotheses to explain this cause: normal development, pathology (e.g., infectious spondylitis), or healed injury. Three specimens, collected from the Upper Cretaceous Mooreville Chalk Formation, were used for paleohistological analysis. They exhibit no indication of macroscopic abnormalities or healed injury. were molded and cast, stabilized by resin impregnation, and petrographically on frosted Plexiglass slides.

Our analysis indicates incomplete in vivo fusion in two of the specimens; however, an unfused specimen shows trabecular bone in the medullary regions of the vertebrae. Towards the cortex of the anterior and posterior margins, the bone tissue becomes denser, histology typical for normal vertebral development. A third specimen shows complete fusion. Trabecular bone density is constant, and no evidence of woven bone (indicative of injury or a pathology) can be observed. Histological evidence thus supports that this is indicative of normal bone development, and shares similarities with normal pygostyle development in birds; however, we cannot rule out remodeling as having erased some record of healed lesion or fracture. Future work should expand the histological sample size available for mosasaur vertebrae, regardless of their gross anatomy.

75 - Analyzing clonal and population structure in the federally endangered Sagittaria fasciculata using a high-throughput sequencing dataset

Skyler Fox[1], Ashley Morris[2]

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The use of microsatellite loci in plant systems to determine genetic structure within and among populations can inform recovery actions for rare plant species. Minimal genetic work has been conducted on *Sagittaria fasciculata* (bunched arrowhead; Alismataceae), a federally endangered species found in mucky seepages within Greenville County, South Carolina and McDowell County, North Carolina. This herbaceous perennial can reproduce clonally, a form of asexual reproduction in which rhizome fragments can produce physiologically independent individuals. The degree to which a species relies on clonal reproduction influences its genetic structure. We developed a genotype-by-sequencing dataset using microsatellite loci for *S. fasciculata* to analyze clonal and population structure to provide recommendations for management strategies. We collected leaf material and extracted DNA from 302 *S. fasciculata* individuals–spanning fifteen sites and five out of the eleven extant populations–and screened 97 microsatellite loci. After eliminating loci that did not amplify cleanly or were not polymorphic, data cleaning, and quality control, the final genetic matrix contained 281 *S. fasciculata* individuals for 35 loci. Multiple sites had a limited number of unique genotypes, indicating that this species is highly reliant on clonal reproduction; therefore, stem counts are not an effective strategy in evaluating numbers of individuals within sites. We also found that less genetic variation is present in North Carolina sites than in South Carolina sites. In South Carolina, genetic connectivity is present between certain sites, but the current population definitions are not consistent with genetic patterns we observed. For example, the Blackwell complex within the Enoree River – mainstem population harbors high genetic diversity and is genetically unique from all

other sites within both the Enoree River – mainstem and the North Enoree River populations. Further studies should focus on the pollination biology of *S. fasciculata* to determine how seed dispersal occurs within and among populations.

76 - Conservation Genomics in the Endangered Whorled Sunflower Helianthus verticillatus (Asteraceae)

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Genetic diversity among and within populations of species is critical for survival in a changing world. Conservation genomics links studies of population genomic variation with conservation managers to provide scientific data for species management strategies. We study the conservation genomics of the whorled sunflower, *Helianthus verticillatus* (Asteraceae), an endangered sunflower species endemic to the southeastern United States. Until about five years ago, only five populations were known to exist in Alabama, Georgia, and Tennessee, but additional populations of the species have been discovered in Mississippi and Virginia. Population genetic work using microsatellites revealed that the Mississippi plants were genetically distinct from all other populations. Since this study, more populations have been discovered in Mississippi; however, these plants have a unique phenotype that does not exactly match the description of *H. verticillatus*. To further investigate these new Mississippi individuals and compare them with the rest of the species, we used a combination of genome-wide SNPs and sequencing of phylogenetically informative loci to assess genetic diversity and relatedness of all known populations. We also included populations of *H. verticillatus*' sister species, *H. grosseserratus*, as we wanted to compare this species to the newly discovered Mississippi populations. *H. grossesserratus* was previously hypothesized to be a parent of the whorled sunflower, so we included this species in our population genomic study to assess any possibility of hybridization between the two species that could have resulted in the unique phenotype of the new Mississippi plants. We report the comparative genetic analysis from a broad set of samples from all known *H. verticillatus* populations and across *H. grosseserratus'* range. The ultimate goal of this work is to provide local conservation agencies with information to foster implementation of the best conservation plans to protect *Helianthus verticillatus*.

77 - Development of Molecular Resources for Genetic Diversity Studies in Sanguinaria canadensis

Megan Clements[1], Matt C. Estep[1], Dr. Jennifer Rhode Ward[2]

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Sanguinaria canadensis (Papaceraceae), is a monotypic, medicinal, spring ephemeral endemic to the Southern Appalachian Mountains. Currently, little analysis has been conducted on the genetic diversity and population structure of this abundant species. Though Sanguinaria is historically common, it has been considered a species of concern and potentially exploitatively vulnerable in the past. The current study attempts to elucidate the genetic diversity of this species via the development of 11 microsatellite markers and the genotyping of approximately 32 individuals from 6 populations located in North Carolina, Tennessee, and Virginia. Our preliminary findings suggest all 11 markers are polymorphic and successfully amplified in the majority of individuals. Data analysis will include an assessment of allelic diversity, heterozygosity, and population structure within and among these populations. A cross-amplification experiment was also conducted in *Sanguinaria's* sister taxa, *Eomecon*, with amplification success in 82% of markers developed. The results of this study will contribute to a more comprehensive understanding of the genetic diversity of Sanguinaria populations and provide further molecular means to monitor and manage populations.

78 - Population Genetics study of Rhododendron minus var. chapmanii

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Rhododendron minus var. *chapmanii,* also known as Chapman's rhododendron, is an endangered perennial shrub native to mesic habitats. Threats to this species include habitat destruction through development and conversion of land to pine plantations and over harvesting. Only 3 populations of this species are known to still exist, some on public land and some on private land. The recovery of endangered species is highly dependent on the amount of genetic variability present across populations. This study focused on individuals from two populations - Hosford on private lands and Gulf County on public lands. We wanted to determine if the two populations were genetically distinct from each other. We sampled leaf tissue from 96 individuals, isolated DNA using a Sorbitol CTAB method, and sequenced after hybridizing to the Angiosperms-353 bait set. Population structure using the Discriminant analysis of principal components shows 2 optimal clusters, indicating that the two populations are genetically distinct from each other. Analyses show a moderate level of inbreeding and very low observed heterozygosity in both populations. These results are highly concerning for the future of this species and will inform future management actions such as population relocation and increased efforts to back the species up as cuttings and seed at the Atlanta Botanical Garden.

79 - Conservation Genomics in the Eastern Hemlock: genomes, metabolomes, and infrastructure-building for reforestation.

Karl Fetter[1], Vidya Vuruputoor[1], Meghan Myles[1], Adam Glendening[1], Hamid Nodeh[2], Tim Cernak[2], Jill Wegrzyn[1]

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The eastern hemlock (*Tsuga canadensis*) is an ecological keystone species and a vital component of healthy forest systems in the eastern US and Canada. In recent decades, the viability of hemlock populations have been challenged by an invasive species that is pushing many, if not all, hemlock populations into severe decline. The hemlock woolly adelgid (HWA, *adelges tsugae*) was introduced into

Virginia in the 1920's and has subsequently spread to nearly all US populations and Nova Scotia, Canada. After a tree has been colonized by HWA it can perish within 4 to 8 years. Given the pressing need for conservation solutions in the Hemlock-HWA system, as well as the advent of genomic technologies and methodologies for assembling and annotating large conifer genomes, the time is right for the development of conservation genomic solutions in hemlocks. Here, I will describe current successes in the Hemlock-HWA system towards assembling and annotating a reference genome, population-level surveys for landscape genomic analysis, and metabolomic investigations for putative identification of candidate resistance terpenoids. These studies are part of a larger working group on conservation genomics in the eastern hemlock and are laying the ground work comparative genomics to understand patterns of HWA resistance, seed banking for restoration, and studies of climate adaptation in this important conifer.

80 - Defining populations and predicting future suitable niche space in the federally endangered leafy prairie-clover (Dalea foliosa; Fabaceae)

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Rare plant species recovery plans often depend on criteria related to stem counts and numbers of populations that meet viability criteria over an extended period of time. However, we are often lacking the biological information that would allow us to meaningfully define the term population. Many land managers use somewhat arbitrarily defined distances between occurrences until other information becomes available. Here we present new information in the federally endangered *Dalea foliosa* using nuclear microsatellite loci to assess how biologically meaningful such delimitations are. We also use modeling approaches to assess potential suitable niche space under climate change over the next 50 years. We find limited genetic structure within the species as a whole, but particularly in the disjunct regions of Illinois and Alabama. Tennessee, which represents the center of the species range, exhibits more variation and structure, but that structure is not consistent with currently defined populations or element occurrences. Models suggest that future suitable niche space may only marginally overlap with known associated geology for this calcareous glade/prairie endemic. More work is needed to understand the extent to which occurrences of the species are locally adapted to microclimate conditions and how this could impact potential translocation efforts.

81 - Investigating the prevalence and effects of neonicotinoid pesticides in a songbird, the Loggerhead Shrike (Lanius ludovicianus), in Arkansas

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Agricultural toxins are known to cause a variety of effects, either detrimental or adaptive, in off-target species. With increasing global food demands, agricultural practices are forced to maximize production, often deferring to industrial-scale operations and chemical application to meet these demands. Sublethal doses of applied chemical toxins, such as pesticides, can influence all levels of organismal biological function, from the cellular to whole-organism scale. The growing literature on one group of widely used pesticides, neonicotinoids, has discovered negative impacts for a wide variety of wildlife, but most of the studies have focused on invertebrate, pollinator species. Additionally, many ecotoxicological studies draw their results from experimental dosing procedures, making it difficult to draw comparisons to natural exposure levels. To add to the currently limited knowledge of toxin accumulation and side effects in vertebrates, we conducted a study on Loggerhead Shrikes (*Lanius ludovicianus*), a predatory songbird, inhabiting both intensive agricultural and semi-natural regions in Arkansas, USA. We tested for a suite of neonicotinoid pesticides in blood samples of shrikes collected throughout the breeding seasons of 2021 and 2022 at agricultural fields in the Mississippi Delta and cattle pastures and restored prairies in the Ozarks. Based on our 2021 sampling, neonicotinoids had widespread prevalence in 24 out of 30 (80%) individuals across both field sites. Within the intensive row-crop region, two neonicotinoids, imidacloprid and clothianidin, were each found in 54% of samples. We then built models to assess the relationships among residue loads, body condition, and/or habitat type. Based on the metrics included in our study, we did not detect any sub-lethal effects of shrike neonicotinoid exposure in an intensive agricultural area. Our findings add to current literature documenting the widespread prevalence of agricultural toxins in vertebrate species and investigating potential sublethal effects of toxin exposure in wild systems.

82 - Shift in freshwater biodiversity and its impact on environmental mitigation cost for hydropower plants in changing climate

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Climate change is forecasted to make drastic changes on the distribution of freshwater fish and mussel species. The reservoirs of hydropower dams that alter the thermal regime of the downstream of the dams may interact with the impact of climate change in influencing the future freshwater species distribution. This change in species distribution may feedback and affect the cost operation of hydropower through affecting their environmental compliance cost. Here, we investigated how the distribution of freshwater fish and mussel species will shift from both the climate change and hydropower reservoirs in the coterminous United States (CONUS), and how that will, in turn, affect the biodiversity mitigation cost of hydropower plants. Using environmental niche modeling, we found that climate change increased the range length of freshwater species by 42 percent on average while thermal impact of reservoirs did not have significant effect on the range length downstream of power plants. Geographically, we projected an increase of species richness in the west and a decrease in the middle and east of CONUS for fish, while projecting uniform increase for mussels. With this shift in

species distribution, we estimated that the biggest changes in freshwater biodiversity mitigation cost will occur in Southeast, with an average decrease of $764,000 per plant, and Northwest, with an increase of $166,000 per plant.

85 - Ex situ conservation of imperiled plant species in the southeastern United States

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Atlanta Botanical Garden (ABG) works to advance the science of conservation through research collaborations and native species recovery programs. ABG's plant conservation collections and field research focus on propagation of under-represented endangered plant groups and the restoration and management of their habitats. In addition to *in situ* work the conservation horticulture team at ABG specializes in *ex situ* collections management and propagation techniques from field to lab to nursery production of imperiled species. The Garden has more than 30 years of experience in the conservation and recovery of rare and threatened species through propagation, collaborative restoration, and habitat management.

Working across the southeastern US and Neotropics, ABG addresses the urgent need to protect imperiled species through *in situ* and *ex situ* conservation, conservation horticulture, restoration and augmentation, seed banking, and capacity building. A central focus of ABG's efforts is the diversification of *ex situ* conservation collections through maternal line tracking, implemented in extensive living collections, micropropagation, seed bank (conventional and cryo bank), and tissue and DNA banks. Furthermore, ABG actively engages in capacity building through its leadership of the Southeastern Plant Conservation Alliance (SE PCA) and the Global Conservation Consortium for Magnolias (GCCM). The SE PCA bridges gaps between local and national conservation efforts, collaborating to restore and prevent the loss of plant diversity. This is achieved by building capacity, facilitating novel partnerships, and leveraging shared resources to stimulate collective success across the Southeast region. The GCCM is a coordinated international network of institutions and experts who work collaboratively to develop and implement a comprehensive conservation strategy to prevent the extinction of the world's *Magnolia* species.

86 - Southeastern Plants Regional Species of Greatest Conservation Need

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The Southeastern Regional Species of Greatest Conservation Need (RSGCN) list is the first of its kind in the U.S. The Atlanta Botanical Garden (ABG) coordinated the creation of this list, on behalf of the Southeastern Plant Conservation Alliance (SE PCA), by working with experts across the region. Project partners include the NatureServe Network, Terwilliger Consulting, Inc., Flora of the Southeastern United States, and the Association of Fish & Wildlife Agencies (SEAFWA) Wildlife Diversity Committee. The Southeastern Plants RSGCN list presents species of conservation concern with regional responsibility and opportunity for collaboration, identifies high level threats and needs, and sets actionable priorities for rare plants across political boundaries. This project is moving the dial forward for plant conservation at the regional and national levels by highlighting the critical role of plants in the face of our changing climate and integrating these activities with broader efforts to conserve wildlife. Identification of ecological systems will inform potential Conservation Opportunity Areas that can be addressed by State & Tribal Wildlife plans and Grants, as well as future iterations of the Southeastern animal RSGCN. These tools will promote more holistic conservation and set the stage for more inclusive and comprehensive and effective landscape conservation.

87 - Spatio-temporal sampling of environmental DNA with metabarcoding can improve biodiversity assessments of fishes in hydropower-impacted systems

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Efforts to utilize renewable energy are becoming more common to balance rising electrical needs. Although strategic utilization of hydropower may be useful in this regard, dams may influence biodiversity loss which is commonly occurring among many ecosystems. As such, biological monitoring for reaches in proximity to hydropower dams is needed to inform and develop efficient hydrological practices. Although conventional gill netting or electrofishing sampling methods are utilized, such efforts may be financially costly, induce organismal stress, and potentially miss detection of cryptic species. Recently, environmental DNA (eDNA) metabarcoding has shown promise for aquatic habitat monitoring, as it offers a non-invasive and potentially more cost-effective means of obtaining community metrics. Utilizing eDNA sampling combined with metabarcoding and occupancy modelling bioinformatic approaches, we evaluate the utility of eDNA as a supplemental tool for assessing biodiversity patterns on the Clinch River, a riverine system impacted by the Melton Hill hydropower installation. Multi-season and spatial sampling revealed trends in species distribution patterns, habitat preferences, and seasonal movement patterns above and below the dam. While single season eDNA estimates largely overlapped with results obtained from conventional sampling efforts, multi-season eDNA sampling revealed greater numbers of species missing from conventional methods for up to 30 years prior to the current study, further validating eDNA utilization to assess biodiversity patterns. The current study indicates that eDNA metabarcoding may be a powerful method to aid in wholistic estimates that inform our understanding of the impacts of hydropower on aquatic biodiversity.

88 - Testing a split-root propagation method to clone American ginseng (Panex quinquefolius L.)

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American ginseng (*Panax quinquefolius* L.) is a long-lived, non-clonal, understory herb distributed throughout eastern North America that is valued for bioactive phytochemicals in its roots. Destructive overharvesting from wild populations for Asian medicine has dramatically reduced population sizes and threatens the long-term viability of the species in the wild. There is increasing interest in understanding the genetic and environmental factors that affect phytochemical production. This knowledge could help the development of specific cultivars for targeted treatments or regional branding. To best test the G x E effects on phytochemical production, genetically identical clones would be planted in different environments to monitor the production of phytochemicals. However, ginseng is difficult to clone by traditional means. In this study, we tried making clones from multiple propagules from single roots. Fresh roots that had been recovered from illegal harvest in fall of 2018 were divided into different propagation classes: undamaged roots with rhizomes (as controls), whole roots with rhizomes, whole roots with no rhizome, proximal root sections with rhizomes, and distal root sections with no rhizome. These propagules were planted in two sites in western North Carolina and surveyed annually through summer 2023. In each survey, presence/absence and reproductive status were noted, and plant size metrics were collected. Each propagule class produced reproductive individuals over the course of five years, but the proportion of sprouting plants differed significantly among propagation classes with the highest proportions of sprouting occurring in the whole root with rhizome and proximal root with rhizome classes and lowest proportions occurring in the distal root with no rhizome class. Less than 40% of all split roots resulted in clones (more than one plant from original whole root). While there was some success in making clones by splitting ginseng roots more work needs to be done to improve outcomes.

89 - Freshwater Mussels Prefer a Diet of Stramenopiles and Fungi over Bacteria

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Freshwater mussels (Mollusca: Unionidae) play a crucial role in freshwater river environments where they live in multi-species aggregations and often serve as long-lived benthic ecosystem engineers. Many of these species are imperiled and it is imperative that we understand their basic needs to aid in the reestablishment and maintenance of mussel beds in rivers. In an effort to expand our knowledge of the diet of these organisms, five species of mussel were introduced into enclosed systems in two experiments. In the first, mussels were incubated in water from the Clinch River (Virginia, USA) and in the second, water from a manmade pond at the Commonwealth of Virginia's Aquatic Wildlife Conservation Center in Marion, VA. Quantitative PCR and eDNA metabarcoding were used to determine which planktonic microbes were present before and after the introduction of mussels into each experimental system. It was found that all five species preferentially consumed microeukaryotes over bacteria. Most microeukaryotic taxa, including Stramenopiles and Chlorophytes were quickly consumed by all five mussel species. We also found that they consumed fungi but not as quickly as the microalgae, and that one species of mussel, *Actinonaias pectorosa*, consumed bacteria but only after preferred food sources were depleted. Our results provide evidence that siphon feeding Unionid mussels can select preferred microbes from mixed plankton, and mussel species exhibit dietary niche differentiation.

90 - How state regulations can limit the sale and spread of invasive plant species: an example from Florida

Patti Anderson

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Exotic species have long played an important role in the agricultural and ornamental plants of the United States. Florida has welcomed many of these species as warmly as tourists to its amusement parks. Estimates of up to 85% of invasive plant species in Florida were introduced as ornamentals through the horticulture industry. Agricultural introductions, such as non-native grasses for forage, provide another source of pest plants. Among our most notorious ornamental introductions are *Melaleuca quinquenervia* (punktree) and *Schinus terebinthifolia* (Brazilian pepper or Christmasberry-tree). Natural dispersal through disturbances such as hurricanes also introduce or spread non-native plant species. Traditionally, state and federal governments focused regulatory activity on noxious weeds known to cause negative economic impacts on agriculture, but since 2002, Florida has added invasive plant species that disrupt natural systems. As part of the Florida Department of Agriculture and Consumer Services, the Division of Plant Industry (DPI) has responsibility for protecting native and commercially grown plant species, in part by regulating noxious weeds and invasive species. Without a requirement for screening exotic species before they are released, Florida's regulatory mechanisms depend on listing species after they prove to be pests. DPI enforces regulations limiting the movement of noxious weeds and carries out decisions made by the state Noxious Weed Review Committee to add or remove species from the list of regulated plants or to exempt sterile cultivars of listed species. The procedures followed by the Noxious Weed Review Committee provide a science-based process for deciding whether a plant should be included on the Florida Noxious Weed and Invasive Plant List. This process can provide a model of regulatory activity for conservation biologists in other states.

91 - Fire Mediated Forest Structure Influences the Dispersal Dynamics of a Bunchgrass

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Maintaining the longleaf pine ecosystem requires establishing frequent low-intensity fire regimes through ground cover restoration. This study examines the impact of burn history on forest structure and its influence on the dispersal distance of *Andropogon ternarius*, a wind-dispersed bunchgrass, across nine North Carolina sandhills sites. Integrating simulated seed dispersal dynamics with terrestrial LiDAR metrics reveals that frequently burned sites exhibit significantly lower vegetation volume at the release height of *Andropogon ternarius* compared to infrequently and rarely burned sites. Infrequently burned sites display the highest vegetation volumes, attributed to leaf retention during dormant seasons. Moreover, a negative relationship between vegetation volume and diaspore dispersal distance is observed. Alterations to wind profiles, rather than vegetation collisions, explain this effect. Understanding the dispersal dynamics of wind-dispersed bunchgrasses not only aids longleaf pine ecosystem restoration but also provides insight into mechanisms contributing to ground layer species diversity in this ecosystem.

92 - I Spy SAV: Exploring the Role of Remote Sensing in SAV Conservation in Currituck Sound, NC

Peggy Mullin

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Coastal submerged aquatic vegetation (SAV) is disappearing globally due to increasing sea levels, storm events, nutrient loading from agriculture, and other anthropogenic impacts. Like marshes and mangroves, SAV provides a host of ecosystem services like carbon burial through sediment trapping, which can mitigate atmospheric CO2. SAV also provides food and shelter for coastal species, facilitating the persistence of coastal ecosystems and contributing to the economic benefits of sightseeing, hunting, and fishing for coastal communities. There is an urgent need to better understand impacts to and rates of change within coastal habitats, in particular SAV presence and persistence. Ground-based mapping efforts are field-intensive and often underestimate SAV extent. In recent years, the spatiotemporal resolution and public accessibility of coastal remote sensing products has increased significantly, representing an opportunity to test the utility of these resources for habitat management. It is more important than ever to accurately map SAV habitats to understand and manage the factors contributing to net losses of ecosystem services in coastal environments. This work aims to use remote sensing products at various spatial and temporal scales to identify areas of SAV persistence and loss in the Currituck Sound of coastal North Carolina, where SAV habitat is both under-mapped and already estimated at significant rates of loss. Ground-level survey field work will be coupled with remotely sensed imagery to test the ability of remote sensing methods to create accurate SAV maps. Additionally, the utility of these methods to constrain other factors affecting habitat persistence, including marsh/shoreline proximity and underwater light availability, will be tested. Working with ongoing project partners in Currituck Sound, this work will directly inform future directions for ecosystem management in coastal NC.

93 - Beneficial reuse of coal ash rather than disposal as waste

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Coal ash, also referred to as coal combustion residuals (CCRs), is produced primarily from the burning of coal in coal-fired power plants. Coal ash is one of the largest types of industrial waste generated in the United States. With recent catastrophic release events from surface ash impoundments such as occurred in Kingston, TN, regulatory scrutiny has increased. However, ash is not necessarily a waste. Ash can also be viewed as an opportunity for beneficial reuse. Beneficial reuse of ash has environmental, economic, and societal benefits that support the view of GREEN technologies. Proposed herein, "GREEN" refers to Good Ranking for the Environment, Economy, and Nation (the people). A triple bottom line approach for assessing ash as a "GREEN" technology was applied at the Savannah River Site (SRS) with the evaluation of 10 ash basins/piles/depositional areas at the SRS from the decades of coal powerhouse operations from the 1950s to the early 2000s that provided electricity to the Department of Energy's 310 mi2 SRS in South Carolina. The GREEN evaluation was applied to develop a comprehensive strategy for the remaining Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) ash waste units at the SRS. Supporting valuations included development of detailed cost estimates for various alternatives such as soil covers, Class III Landfill geosynthetic cover systems, excavation and backfill, and land use controls along with beneficial reuse. The assessment is based on previous remedial/removal actions implemented at other SRS ash basins and overflow areas, and included volume estimates of ash based on historic topography and recent LiDAR interpretations; it also included an opportunity for a Carolina bay restoration. It is anticipated that the approach applied at SRS could also be used to evaluate similar alternatives for various ash sites across the nation for a GREEN approach to beneficial reuse of ash.

94 - Comparison of orb-weaving spider diversity, geographic distribution, and phenology in Eastern TN and Northwest GA.

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Since its first appearance in Braselton, GA, in 2014, the Joro spider (*Trichonephila clavata*) has spread to many locations, including recent sightings in northern TN, WV, and as far north as Baltimore, MD. Its continued spread and the fact that it has become the most observed orb-weaving spider in the greater Atlanta area suggests the need to carefully monitor this species and the presence, abundance, and diversity of native orb-weaving spider species. Very little is known about how orb-weaving spider diversity varies across east TN and north GA. In this study, we repeatedly surveyed locations in Nashville, TN; Chattanooga, TN; Calhoun, GA; and Atlanta, GA, to determine if locations vary in species presence, abundance, and diversity. In addition, we report on the phenology of orb-weaving spiders from early July through the end of October. We repeatedly surveyed locations on a two-week cycle, and each general location included parks and greenspaces in urban, suburban, and rural areas. We found that locations in Nashville consistently had significantly lower diversity than the other locations, while there was no difference between the diversity we observed in Atlanta, Calhoun, and Chattanooga. For the species we observed most often, we generally saw that abundance increased with Julian days for all species except

the Basilica orb-weaver (*Mecynogea lemniscata*). Lastly, at our Atlanta locations, we observed small juvenile spiders at the beginning of our survey and again in mid-September , where we found both larger adults and small juveniles simultaneously. Our preliminary results provide context to the Joro invasion and suggest that Joro's timing and growth may differ from native species. However, locations furthest from where the Joros have been established the longest are not more diverse overall.

95 - Mortality of Eastern Bluebirds following a severe winter storm

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Eastern Bluebirds (*Sialia sialis*) roost communally during the winter, possibly to conserve heat. They have been found dead in nest boxes following severe snowstorms. Bluebirds prefer to feed on arthropods which can be difficult to find when leaf litter is covered with ice and snow. In 2021, Bob and Judy Peak collected 90 dead bluebirds from nest boxes at Land between the Lakes in northwest Tennessee and southwest Kentucky. Our goal was to gather information about these birds and look for possible causes of mortality. We began by recording the sex, age, weight, and condition of each specimen. The weight of the dead bluebirds was lower than expected for healthy bluebirds, so we hypothesized that they may have starved to death and therefore their stomachs would be empty suggesting that they were unable to find food before roosting the night that they died. The stomachs (proventriculus and ventriculus) were removed, and their contents inventoried. Most of the stomachs were almost or completely empty. The must abundant items found in the stomachs were seed coatings, while the least abundant were arthropods and arthropod parts. Unexpectantly, 81% of the stomachs contained some amount of blood. In addition to examining the stomach contents, the intestines were removed and examined for helminth parasites. The most common parasite encountered was *Capillaria obsignata*. One possibility for the blood found in the stomachs may have been a bacterial or viral infection. With this in mind, we screened a subsample of the birds for clostridial enteritis. No evidence of infection was found. Overall, we suspect that the mortality of these birds is from a combination of factors complicated by the inability to find food prior to roosting for the night.

96 - Long-term soil fungal responses to proactive forest management for Spongy Moth prevention in Daniel Boone National Forest

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White Oak (*Quercus alba* L.) populations are declining across the Eastern United States due to changes in the disturbance regime, poor seedling recruitment, and various native and introduced pests. One invasive pest of concern is the Spongy Moth (*Lymantria dispar* L.) which causes widespread defoliation and is spreading southwestward. Though the Spongy Moth has not yet reached the Cumberland Plateau, US Forest Service land managers of the Daniel Boone National Forest (DBNF) implemented proactive reforestation in 2007. These consisted of five different silvicultural prescriptions including an oak shelterwood and oak woodland treatments. The oak shelterwood treatment consisted of removal of midstory undesirable tree species using herbicide (triclopyr) to increase light available to regenerating oak seedlings in preparation for final overstory removal, which occurred in 2020. The oak woodland treatments consisted of forest thinning to approximately 11 m2/ha of overstory basal area, followed by prescribed burning every 3-5 years to reduce understory and favor fire-dependent forbs, grasses, and oak regeneration. The understory in the oak shelterwoods was manually cleared and treated with glyphosate and imazapyr in 2022 in preparation for an oak outplanting experiment. Soils from six plots (three replicates of the oak shelterwood and three replicates of the oak woodland) were collected (18 per plot; N=108) in Spring 2023 from planting locations of white oak saplings. From these, genomic DNA was extracted and metabarcoding sequencing (Illumina MiSeq) was conducted targeting fungal communities (ITS2). We see that long-term proactive forest management strategies lead to changes in fungal community structure and key fungal taxa. Further, changes in relative abundances of functional groups, including plant pathogens and soil saprobes, are linked to management strategies. These results provide insights that forest land managers can use to balance forest management regimes with soil health and functionality for forest sustainability.

97 - Meta-analyses of the ecological effects of urban form: sprawl versus compact residential development

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The expansion of residential development is among the fastest growing and least reversible drivers of global land use and land cover change. Here, we report the results of the first quantitative synthesis of the ecological effects of urban form, a central issue in the management of the impacts of residential development. We systematically searched the literature to identify studies that either empirically compared ecological responses in existing compact and dispersed developments or modeled the projected impacts of urban form using development scenarios. Twenty-three journal articles met our criteria. Of these, 30% (7 articles, 5 studies) compared ecological responses between existing dispersed and compact developments and 70% (16 articles, 15 studies) modeled the projected ecological impacts of urban form. Most studies took place in eastern North America (35%) or western Europe (22%) and measured avian or mammalian diversity as the response variable. For empirical studies, we calculated a positive overall effect (Hedges' *g*) of 0.23 (95% CI: 0.21-0.25), indicating that compact development is associated with more positive ecological outcomes than dispersed development. The best model of the effects of moderator variables on empirical study effect sizes showed that ecological responses were more positive in compact developments only when urban form extent was large and investigators measured habitat amount or

biomass. For modeling studies, the overall effect was also positive, although weaker (response ratio (L) = 0.02 (95% CI: 0.01-0.03)). The best models of the effects of moderator variables on modeling study effect sizes included latitude, urban form extent, and biome, which, when accounted for, resulted in non-significant overall effects of urban form. We conclude that 1) the effects of urban form depend on spatial scale and ecological response measure and 2) that heterogeneity among studies published to date precludes an easy answer to the urban land sparing/land sharing debate.

98 - Shrub Expansion Enriches Soil and Groundwater on an Uninhabited Barrier Island

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Barrier islands provide numerous ecosystem functions, most notably providing protection to landward habitat and infrastructure from storms and sea level rise. As islands accrete and erode sediment, transitions occur in ecosystem states. Along the Atlantic and Gulf coasts, grasslands are rapidly transitioning to shrubland and very little is known about the effect on carbon (C) cycling within these islands. To bridge this knowledge gap, we quantify soil and groundwater C content of grassland and shrubland, two common upland ecosystems that are experiencing rapid transition. On Hog Island, Virginia, we measured soil C, soil organic matter, and groundwater dissolved organic C and nitrogen (N). C and N stocks were highest in soils and groundwater of the oldest shrublands relative to younger shrubs and grasslands. Soil organic matter under the oldest shrubs was comparable to those in temperate forests. In a leaf litter leachate incubation experiment, we found little difference between old and young shrub dissolved organic C decay suggesting litter quality is not the main factor controlling high C accumulation in the oldest shrublands. Our data show that conversion to shrubland has a significant impact on the edaphic conditions and C cycling dynamics in barrier islands that is not yet fully understood.

99 - Greening the Edge: Investigating Riparian Buffer Restorations in a Pastoral Setting and their Effects on Soil Carbon and Microbial Community Composition.

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Riparian forests have been well documented for their ecosystem functions and services including improving water quality by reducing soil erosion and nutrient runoff, creating biodiversity hotspots, and serving as a natural solution to climate change through carbon sequestration. Riparian forests tend to be more productive compared to their upland counterparts and models have predicted that riparian zones can potentially sequester significant amounts of carbon within their soils. Soil microbes play an important role in the soil carbon cycle but are rarely investigated in studies on carbon sequestration. Additionally, land use change can have profound impacts on soil physicochemical properties but the associated changes in soil microbial communities are poorly understood. In this study, I investigated the efficacy of riparian buffer restoration for improving soil microbial community composition, while also determining how these changes impact long-term soil carbon sequestration. I determined the belowground response to restoration efforts by surveying a chronosequence (0-30 years) of restored riparian buffers. Each restored riparian buffer was paired with an upstream, unrestored pasture to account for differences in soil type and land-use history among restoration sites. Fieldwork was conducted in early June 2023 and all soil samples were collected within two weeks. Soil microbial community composition was assessed using phospholipid fatty acid analysis (PLFA) and 16s metabarcoding. Additionally, soil physical and chemical properties (moisture, pH, bulk density, total nitrogen, and total carbon, cation exchange capacity, micro and macronutrients) were assessed. By comparing soil quality indices between our treatment and control sites I identified belowground impacts of riparian buffer restoration and developed suggestions for the optimal restoration conditions for improving soil microbial communities and long-term carbon sequestration. We predicted that restored riparian buffers would have a greater diversity of microbial composition and higher soil carbon concentrations than riparian areas where cattle are present.

100 - Factors Impacting Greenhouse Gas (GHG) Fluxes in Conservation Reserve Program (CRP) Hardwood Forests

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Soil carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are the primary greenhouse gases in forest ecosystems. Greenhouse gas (GHG) fluxes are strongly influenced by abiotic and biotic factors. The GHG flux on the afforested site, especially in government afforestation programs, is less known. In this study, we used the static chamber method to investigate these three gases from the Conservation Reserve Program (CRP) hardwood forests of varying ages in the southeastern US. Analysis of variance, correlation analysis, and Random Forest Analysis are conducted to determine the main parameters influencing the GHG fluxes. This study determined the magnitude of CO_2, N_2O, and CH_4 gas fluxes in the CRP forest soil, presented the variation in GHG flux at a seasonal pattern, examined the impact of multiple factors on greenhouse gas fluxes across a gradient of sites varying in soil properties (temperature, moisture, pH, bulk density), plantation age, leaf area index (LAI), diameter at breast height (DBH), height, and climate characteristics (air temperature and relative humidity). We observed that N_2O, CH_4, and CO_2 significantly vary by season and sites, but forest ages did not show a significant relationship with GHG flux. Additionally, links between GHG and plant physical characteristics (LAI, DBH, and tree height) are weak or nonexistent in a linear sense. Bulk density, pH, Water-filled pore space, and litter depth showed different importance in the growing season and non-growing season. This research will contribute to understanding the role of the forest ecosystem and the government afforestation programs on climate change in the southeastern US.

101 - Native vegetation community development and invasive species management in small-scale coastal living shorelines within a 10-year chronosequence.

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As global sea level rise becomes a growing concern around coastal communities, nature-based solutions like living shorelines have become prioritized to protect upland areas from erosion and sea level rise. However, the ability of nature-based solutions to carry out their primary objective of upland area protection is partially dependent on the health and longevity of the re-established plant community. Goals to improve re-established vegetation health include increasing native plant coverage and biodiversity as well as minimizing the presence of an invasive species as time progresses. Approaches such as manual planting are utilized to help achieve these goals in living shorelines. However, in a variety of systems (i.e. Atlantic Coast, Gulf Coast, Great Lakes), plant communities are under threat of *Phragmites australis* invasion as they decrease ecological restoration efforts through homogenization. Although several control methods for *Phragmites* have been implemented, hand-clipping may prove efficient for small-scale sites like living shorelines. In this two-part study, we investigated factors controlling plant diversity and presence of invasive species in small-scale living shorelines in coastal Virginia.

In part one, plant species diversity and plant cover were measured along a 10-year chronosequence in the Hampton Roads area in Virginia. With a total of 17 sites, we examined the impacts on time as well as site-specific hydrogeomorphic conditions on plant community development. In part two, we compared the effects of *Phragmites* removal frequencies (bi-weekly, monthly, and no control) on *Phragmites'* plant traits (specific leaf area, leaf area index, dry mass, total height) and the surrounding plant community (species cover, species richness, average plot vegetation height) in a restored shoreline on the Lafayette River, Norfolk, VA. As coastal communities and practitioners increasingly use nature-based solutions to address coastal challenges, understanding vegetation community development and invasive plant species removal impact is essential to informing future restoration efforts.

102 - Effects of lithium and cobalt on algal symbiont density in *Exaiptasia diaphana* anemones

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Heavy metal pollution threatens the health of coral reef ecosystems. Two heavy metals in particular, lithium and cobalt, are quickly increasing in consumer popularity for the production of lithium-ion batteries; however, due to a lack of sustainable extraction and recycling practices for both elements, their concentrations in the ocean are projected to increase. Little is known about the effects of lithium and cobalt on reef-building cnidarians and their symbiotic, dinoflagellate algae. In this experiment, I tested the effects of exposure to lithium, cobalt, or a combination of lithium and cobalt on the algal densities of *Exaiptasia diaphana* sea anemones. I hypothesized that anemones exposed to these heavy metals would demonstrate bleaching, as indicated by a significant decrease in algal density compared to control anemones. I first inoculated the sea anemones with *Breviolum minutum* algae over two weeks and then exposed the anemones to environmentally relevant concentrations of lithium and/or cobalt over three weeks. Finally, I measured the change in algal density in tentacle clippings using fluorescence microscopy. Anemones exposed to cobalt, either alone or in combination with lithium, demonstrated bleaching by showing a significant decrease in algal density compared to control anemones. The results of this study demonstrate a need for the development of measures that can reduce the deposition of cobalt and lithium in areas proximal to coral reef ecosystems. In a future experiment I plan to test the effects of other heavy metals and aquatic pollutants on algal density and host reproduction. Further experiments should also consider the mechanisms underlying bleaching in cnidarians exposed to heavy metals.

103 - Dune grass physiology in a warming climate

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Dunes are built through biophysical feedback of sediment transport and species-specific morphological growth characteristics. Species composition along a dune can inform the stability and protection of interior communities from storm induced damage and sea-level rise. Along the Virginia coast, dune grasses are the dominant growth form and several species that have not overlapped historically are experiencing range expansion due to climate warming. Invasive species are also becoming more prevalent, due to climate warming. *Carex kobomugi*, an invasive sedge, has become a dominant species at Back Bay National Wildlife Refuge, VA. To enable future predictions of dune species composition, we quantified physiological thresholds to warming. Using 4 dominant dune species along the mid-Atlantic coast: *Ammophila breviligulata*, *Uniola paniculata*, *Panicum amarum*, and *C. kobomugi*. In a growth chamber, plants were subjected to temperature changes, starting at 25°C to 40°C in 5 degree increments. At each temperature photosynthetic rate and stomatal conductivity were measured using a Li-6400. At 25°C and 35°C light and fluorescence curves were measured from 0 to 2000 PAR. In the field, stomatal conductance and fluorescence data were collected for each species, 4 times throughout the growing season. Physiological responses to temperature differed across species. *Panicum* had lowest net photosynthetic rates at 25°C and highest at 35°C with similar electron transport rates to *Uniola* at 35°C. *Carex* had the highest net photosynthetic rates from 20 to 30°C. *Ammophila* performed similarly to *Uniola* at temperatures 25 - 40°C. As climate continues to warm, species that thrive in warmer temperatures may dominate (i.e. *Panicum*), while those that prefer cooler temperatures may have lower performance (i.e., *Ammophila*). These data are important for determining species interactions and influence on future dune shape and size. They can also be used to inform management decisions for dune plantings and restorations that account for climate warming.

104 - Effects of Warming on Four Moss Species from the Southern Appalachian Mountains

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The year 2023 was the hottest year on record and nearly all years in the 21st century have been warmer than those in the preceding century. Many high elevation organisms in the Southern Appalachian Mountains (SAM) are glacial relics and warming could result in their extirpation, or extinction if they are endemics. Most at risk could be lichens and bryophytes, who depend primarily on atmospheric moisture for their water and nutrient inputs, since warming would enhance evaporation rates and drying, raise respiration rates, and alter competitive relationships among species, all of which could lead to declines. There have been no studies of how SAM mosses might respond to warming, so we undertook an experiment to grow four species outdoors in containers with native soils, for ~1 year, with half warmed by ~3-4°C using IR lamps and the other half unheated. We used two species common to open habitats (*Polytrichum juniperinum* and *Ceratodon purpureus*) and two from forest understories (*Thuidium delicatulum* and *Hypnum imponens*). Understory species were grown at reduced light beneath shade cloths and all mosses received water only from natural rain events. All four mosses survived warming, but *P. juniperinum* and *C. purpureus* showed lower Fv/Fm in the warming treatment while *T. delicatulum* and *H. imponens* did not show a significant difference between ambient and warming treatments. There was no treatment effect on total chlorophyll content and chl a:b ratio among all four of the species. Results from our short-term study indicate that SAM mosses have the capability of tolerating moderate warming, but that their long-term survival may depend on feedback effects resulting from altered competitive interactions that can only be determined by performing such studies in the field under natural conditions.

105 - Patterns and potential mechanisms of phenotypic changes in urban small mammals

Leslie Lopez, Brianna Casement, Nicholas Green

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Urbanization is a type of human induced rapid environmental change that can have significant ecological effects including habitat destruction, fragmentation, and alteration of local climates. Effects of urbanization have been shown to negatively impact wildlife through the creation of novel environments and selective pressures that lead to individual-level changes in morphology, physiology, or both. We investigated how body size and energy balance vary in small mammals along the urban-to-rural gradient. Small mammals—mice, rats, chipmunks, etc.—are important model organisms because of their numerous roles in terrestrial ecosystems. We trapped small mammals at 23 sites along an urban-to-rural gradient centered in Atlanta, Georgia, USA from May-August 2023. For each individual, we recorded species, sex, reproductive status, body mass, total length, whole blood cholesterol (CHOL), triglycerides (TRIG), and high-density lipoprotein cholesterol (HDL). Body mass was modeled as an allometric function of length to calculate mass-length residuals (MLR) for each individual. We modeled physiological endpoints to assess the impact of environmental and anthropogenic factors associated with urbanization on animal morphology and health. Preliminary analyses suggest that TRIG and HDL are sensitive to urbanization, while CHOL and MLR are not. Total CHOL may be limited by MLR, but other blood endpoints are unrelated to MLR. However, total length appeared to vary with urbanization as white-footed mice (*P. leucopus*) were smallest in suburban sites while chipmunks (*T. striatus*) were smallest in urban sites. In conclusion, sites did not appear to offer different resources, at least not in a way relevant to small mammals. The hypothesized caloric surplus expected in urban sites was not evident in morphological or serological data because TRIG—a proxy for nutritional status and energy balance—was lowest in suburban animals but greatest in rural and urban animals.

106 - Do sexually dimorphic traits explain light-associated spatial segregation of the sexes in the plant, Marchantia inflexa?

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Plants have evolved many strategies (e.g. leaf anatomy or pigmentation) to mitigate tissue-damaging high light. Often, in vascular plants, these strategies have been linked to inter- and intra-specific distribution patterns along light gradients. Sometimes sex-specific distributions are linked to sexually dimorphic traits. In non-vascular plants with separate sexes, spatial segregation of the sexes (SSS) is common, but how light gradients and sexually dimorphic traits correlate with SSS is not well-understood. To test if sexually dimorphic traits lead to SSS along light gradients in non-vascular plants, we used *Marchantia inflexa* whose males are found in higher light than females. We grew 25 males and 25 females to sexual maturity in a greenhouse with one clone of each plant in low or high light and assessed traits in vegetative and sexual thalli (analogous to leaves). We expected that males compared to females would exhibit traits more consistent with high light acclimation (i.e. lower total chlorophyll and specific thallus area but higher chlorophyll a/b ratio, carotenoid/chlorophyll ratio, and dry matter content). Further, we predicted greater sex-differences in sexual thalli due to differences in sex function. For sexual thalli, males had higher carotenoid/chlorophyll ratios (consistent with expectation) while females had higher chlorophyll a/b ratios and dry matter content (opposite from expectations). Vegetative thalli were not sexually dimorphic. Overall, vegetative and sexual thalli differed more for males than females, but these differences were unrelated to light. For one trait (dry matter content), sexual and vegetative thalli differed more for females than males. These patterns do not clearly explain light-associated SSS. However, our results suggest that modifications (vegetative to sexual) of all but one trait are more tightly correlated with male than female sexual function.

107 - Examining how exotic species alter flower availability in invaded plant communities

Matt Heard, Asher Amundson

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Plant invasions can drive phenological modifications within plant communities and alter species interactions over time. Of particular importance may be flowering time and duration, which could alter plant-pollinator interactions. In this study, we examined how exotic plants have altered the phenological calendar and shifted the availability of flowers for pollinators throughout the year in city parks in Nashville, TN. To determine this, we downloaded iNaturalist research grade photograph observations of plants (Kingdom Plantae) from the Global Biodiversity Information Facility (GBIF) for the time period of January 1st, 2019 through December 31st, 2022 (n=6,592 observations; all observations <50m geographic coordinate certainty from Davidson County, TN in GBIF). We then further filtered our data by extracting all flowering plant occurrences (Classes Liliopsida and Magnoliopsida) that were within the boundaries of Metro Nashville Parks, which gave us a final dataset of 2,322 observations. Using these downloaded observations, we then scored each photograph to determine whether a flower was present, whether the species was native or exotic, and when the photograph was taken. We then used this new dataset to determine how the presence of native and exotic flowers varied throughout the calendar year in 2019, 2020, 2021, and 2022. Using this approach, we found that exotic species have extended the availability of flowers throughout the year into wintering months and also increased the number of species with flowers present. However, we also found that these results varied from year to year. Collectively, we believe that our approach provides a novel method for examining how plant invasions can phenologically modify communities over time. However, we suggest that more research is needed to understand the biases that can be present in citizen science data and whether the presence of exotic flowers can drive changes in pollinator preference or behavior over time.

108 - Environmental DNA metabarcoding as a new tool to detect historical pollinator-plant interactions.

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Environmental DNA (eDNA) is any genetic material left behind by an organism on an environmental substrate. Animals may use plants for shelter or food, leaving behind DNA in the form of secretions or shed cells in the process. An emerging use of eDNA is the investigation and monitoring of pollinator interactions from animal DNA extracted from flower material. Recently published studies have demonstrated pollinator and herbivore eDNA can be successfully extracted, amplified, and identified from fresh flowers. Traditional pollinator observation and monitoring techniques are typically expensive, time consuming, and are limited to extant plant populations. More importantly, pollinator observation studies represent just a small snapshot of pollinator communities and cannot provide any historical context for temporal shifts in assemblages. For rare plant species, the ability to document temporal changes in plant-pollinator interactions may lead to a better understanding of the factors contributing to rarity. Moreover, understanding how species associations vary over longer time frames may provide new avenues for conservation efforts of both plants and pollinators. Presented here is a new application of eDNA metabarcoding, where pollinators are detected and identified using eDNA extracted from both fresh flowers and preserved flowers from herbarium specimens. All eDNA extractions were preformed using a modified animal DNA extraction protocol to ensure maximum yield. Next-generation sequencing and metabarcoding of pollinator eDNA was achieved using the Illumina NextSeq1000. Unique sequences were identified using BLASTn against the NCBI, COins, and MIDORI2 nucleotide databases. Vertebrate and arthropod DNA were detected in both fresh and preserved specimens, including Ruby-Throated Hummingbirds from *Lobelia* and *Hypericum* material. However, some taxa are underrepresented in the data. The underrepresentation of bees specifically poses new questions to the viability of eDNA to replace traditional methods for the accurate monitoring of pollinator communities.

109 - Weekly Floral Survey of Collins Gulf in Savage Gulf State Park during Spring 2023: A Learning Process.

Ben Thornton[1], David Steen[2], Roger Hall[2], Matthew Gano[1]

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Weekly, between February 2 and June 12, 2023 (17 weeks), we attempted to identify most flowering plants, including a few trees, and document their developmental stage and relative abundance. We classified developmental stages as emerging, leafing, flowering, fruiting, and senescent and documented the timing of each stage for all species observed. The relative abundance of each species was estimated as 1, 10, 100, or more than 1000 individuals of each species. One hundred and fifty-seven species were identified over the course of the study. Twenty species were rare, and less than ten individuals were observed. Of these, 20 species were considered rare (less than ten individuals observed), and 13 of these were identified in only one zone. Twenty-one species were abundant, estimated to be represented by more than 1000 individuals each at some point in the study. The trail was divided into five consecutive zones differing in their environmental milieu. We recorded the date of the first observation of each species within each zone. We observed that the dates of developmental stages in some species were highly synchronous while others were not. As expected, developmental stages of some species appeared for only a day or two while others were longer lasting. Of the 157 species we identified, 38 were limited to one of the zones, and 13 were observed in all five zones. We note, of particular importance, that three times as many species have restricted ranges in this study compared to those found ubiquitously.

110 - Habitat use and morphology of wintering sparrows in the North Carolina Piedmont.

Kaycee Doherty, Joe Poston

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Among birds, anatomy has a very strong relationship to diet and foraging techniques. In particular, beak dimensions are a very good indicator of the diet of a species and the niche it may occupy within a community. Among seed-eating birds, larger beaks are generally more useful for eating larger seeds, whereas smaller beaks are more useful for eating smaller seeds. Because of this relationship between beak size and diet, similar beak dimensions between species implies competition. Recently, habitat management on the Catawba College

campus has created a favorable habitat for wintering Swamp Sparrows (*Melospiza georgiana*). This study investigates the relationships among these "newly-arrived" Swamp Sparrows and two other species of sparrow that occur on campus in winter: Song Sparrows (*M. melodia*) and White-throated Sparrows (*Zonotrichia albicollis*). This study documents anatomical similarities and differences among these sparrows and measures their habitat use. This study contributes to our understanding of how sparrows divide up resources to reduce competition.

111 - Soil Bacterial Diversity Increases with Spring Ephemeral Diversity in Soil Bacterial Communities Structured by Slope Type and Season on White Oak Mountain in Tennessee

Matthew Gano, Timothy Trott

Southern Adventist University, Collegedale, TN

Soil microbial communities have essential roles in terrestrial biomes, performing numerous key ecosystem processes, including nutrient acquisition; carbon, nitrogen, and phosphorus cycling; and soil formation. The ability of soil microbial communities to provide these ecosystem processes depends on the microbial community's structure and diversity. The plant communities, seasonal changes, and microclimate can all alter the structure and diversity of soil microbial communities. While the structuring effect of tree and shrub communities in temperate deciduous forests on soil microbial communities is well-documented, little is known about the influence of spring ephemerals, another crucial component of temperate deciduous forests, on soil microbial community diversity and structure. Consequently, this study examines how spring ephemeral diversity, season, and microclimate, as indicated by slope type, structures the soil microbial community diversity and composition of the second-growth oak-hickory forests on White Oak Mountain in Southeast Tennessee. The soil microbial community was characterized by 16S/18S/ITS rDNA amplicon sequencing of total DNA extracted from soil samples normalized for each of the ten sample plots. The results from these experiments demonstrated that the bacterial community of White Oak Mountain is structured by both slope type and season and that bacterial but not fungal diversity has a significant positive relationship with spring ephemeral diversity. In addition, these experiments resulted in the first characterization of the soil bacterial and fungal community of White Oak Mountain, Tennessee.

113 - Land use impacts on benthic macroinvertebrate diversity in Lawson's Fork Creek (Spartanburg, SC)

Jillian Hethcox, Amelia K Atwell

Wofford College, Spartanburg, SC

Urban centers have become an important aspect of the United States, with most of the country's population living in or near them. One urban center that has seen population growth of over 50,000 in the past decade is Spartanburg, South Carolina. This increase in population has led to concerns over stream health in the area as urbanization has been shown to degrade streams by increased erosion, decreased water quality, and reduced biological diversity. Due to its location in the city of Spartanburg and potential impacts from urbanization, stream health metrics were investigated in Lawson's Fork Creek (LFC). Stream health was assessed at 12 sampling locations along LFC using benthic macroinvertebrate indices, physicochemical measurements, and an instream habitat assessment. Additionally, land use and impervious surface cover were used to measure urbanization. Negative correlations were found between EPTR (families Ephemeroptera, Plecoptera, and Trichoptera richness) and TTR (total taxa richness) with %urbanization while %forest cover exhibited a positive correlation with EPTR. EPTR was also positively correlated with pH and %sand while TTR was positively correlated with water temperature (°C) and pH. No correlations were found between benthic macroinvertebrate indices and imperious surface cover. Findings of this study demonstrate the sensitivity of stream health and benthic macroinvertebrate diversity to the continued growth and urbanization of Spartanburg, South Carolina.

114 - Long-term Survivorship and Species Invasion Post-Restoration on Rocky Branch

Lauren Willhite

NC State University, Apex, NC

Rocky Branch is a restored urban stream completed in three phases on NC State's campus, providing a unique opportunity to examine plant communities 21 (Phase I), 17 (Phase II), and 13 (Phase III) years post-restoration. For planted species, we assessed survivorship and well-performing species and for invasive species, we identified the highest-impact species. At every third 10-meter transect along the stream, we did stem counts, species classification (planted, native volunteer, non-native volunteer, or invasive), and cover class by invasive species and by strata. Planted species were noted in every transect. Planted species accounted for 23.7% (2343 stems) and invasives for 47.1% (4696 stems). The most common planted species by number of stems was wax myrtle (Morella cerifera), Carolina allspice (Calycanthus floridus), American elderberry (Sambucus canadensis), tulip poplar (Liriodendron tulipifera var. tulipifera), and sugarberry (Celtis laevigata). Cover class data suggests that the highest impact invasive species are Helix hydra, Ligustrum lucidum, Microstegium vimineum, Pyrus calleryana, and Ligustrum sinense. Indicator species analysis was done and further delved into invasives across phases and successional stages. Based on these results, species functionally similar to these high-performing native species should be included in future planting lists. Furthermore, continued, targeted management of high-impact invasives is essential to the long-term success of restored urban streams' plant communities. Based on the successional stage additional species to target will vary. Overall, these results allow us to better understand the success of frequently planted native species and which invasive species to target for control/removal, which can inform future investment decisions and planting lists for restoration projects in the southeastern US.

115 - Land Use Change and Carbon Storage in Piedmont Forest

Akani Bey, David Vandermast

Elon University, Elon, NC

As climate change worsens, people seek mitigation strategies that include conserving forests. This research project aims to evaluate how effective southeastern US temperate forests are at storing carbon. Our study site is Cane Creek Mountains Natural Area (CCMNA), an Alamance County park. We investigated how land use has changed over a 79 year period. Using GIS software, we digitized aerial photos with about 10 year intervals between 1939-2018 using categories like non-forest, logging, hardwood, pine, and mixed pine-hardwood. We used ground truthing to collect field data at 83 sample sites. We found that the total forested area increased 46.1% from 1939-2018 (240.8 to 352.1 hectares (ha)). Pine forests increased 42.3% (53.1 to 82.7 ha) between 1939 and 2010 but logging in 2014 removed 44.6 ha of pine forest. We estimated the secondary successional transition of pines to hardwoods as 22.7 hectares, a decrease of 27.4% in pine area. During these successional changes from agricultural field to pine to hardwood, more carbon will have been stored in woody tissue as oak and hickory species have denser wood than do pines. Allometric equations were used to calculate the carbon sequestered by the forests using the 2023 field data. We found that CCMNA stores 190.7 Mg/ha CO2e. The existence of a mature hardwood forest in 1939 and our field data point to the presence of a forest of continuity (FOC) at CCMNA. A FOC is as much like old-growth as would be expected in the Piedmont of North Carolina. The existence of this forest signifies the potential to study a very rare Piedmont forest (most similar to an old growth forest) with a higher potential for carbon sequestration and with unique species rarely found elsewhere in the Piedmont.

116 - Edge Effects and Species Spillover Vary Across Different Agricultural Contexts

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Anthropogenic activities, such as rapid agricultural expansion, have led to declines in biodiversity and fragmentation of natural habitats. Incorporating non-crop habitat within agricultural landscapes can enhance biodiversity and promote ecosystem services like biological pest control through spillover. Spillover of beneficial arthropods from non-crop habitats into crop systems serves as effective pest management without the financial or ecological detriments; however, spillover in the opposite direction is less understood. We sought to reveal more about the functional diversity of non-crop edges surrounding differing crop varieties, corn and soybean, to gain greater insights to the overall community dynamics of agroecosystems. Fourteen agricultural fields in Wood County, Ohio were selected based on crop variety and presence of vegetation patches. Arthropods were sampled using sweep-nets, identified, and categorized into one of four functional groups based on their ecological roles. We collected over 18,000 arthropods belonging to 482 different taxa. We discovered that corn and soybean field edges shared similar species composition and diversity as indicated by their Shannon and Simpson's diversity indices. Both crop variety edges were dominated by herbivores with approximately 50% of arthropod species collected belonging to this functional group. A two-way repeated measures ANOVA revealed no significant difference between the species richness of the crop edges. Corn and soybean as cultivated crops offer similar resources, so it is understandable to see similarities in their arthropod communities. Given the analogous nature of these agroecosystem edges, similar management strategies could be implemented, thus streamlining pest management practices for farmers. Simplifying pest management with the use of natural ecosystem services like biological control could improve quality of product and overall biodiversity. Continued investigation of functional diversity as well as more focused analysis of species interactions could enhance our understanding of agroecosystems and our ability to formulate useful conservation management practices in the agricultural industry.

117 - Community assembly dynamics of biofilms from an intermittent stream in West Tennessee

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Streams in West Tennessee are highly modified and channelized due for agriculture or flood prevention. Consequently, these streams often have ecological dynamics that respond differently that more natural systems. However, studies comparing ecological dynamics between modified and natural streams in West Tennessee are lacking. Furthermore, there is renewed interest in restoring these degraded streams but understanding of how these restorations might impact aquatic biodiversity, especially microbial communities, is unknown. Here, we investigate community assembly dynamics of aquatic biofilms (prokaryotic and eukaryotic) in a degraded stream (scheduled to be restored) compared to a natural stream in the same watershed. In Little Muddy Creek (degraded) and Bear Creek (natural), we established biofilm sampling plots, consisting of submerged acrylic tubes. Both clear and opaque tubes were used to filter for autotrophic and heterotrophic dominated communities. All tubes were submerged for 7-, 14-, 21-, 28-, and 35-days across a staggered implementation timeframe in late summer 2023 to control for seasonal and temporal variation. From these we conducted metabarcoding targeting bacteria (16S V4) and eukaryotic (18S) microbes using Illumina MiSeq. Additionally, at each sampling timepoint, we collected stream physiochemical data (pH, dissolved oxygen, oxidation-reduction potential (ORP), electrical conductivity, total dissolved solids, potassium and nitrate concentrations, and temperature). Using a community assembly analytical framework, we see major site differences where communities differ between the degraded and natural streams. Further, it was seen that community assembly was driven predominantly by deterministic drivers, and there were strong temporal effects on community structure and stream chemistry. This work highlights that in order to restore degraded streams in West Tennessee, attention must be given to aquatic microbial communities as bioindicators of ecosystem health and resiliency.

118 - Comparison of Gut Microbial Communities from American Pikas and Yellow-bellied Marmots in the La Sal Mountains, Utah

Thelonius Crouch, Liesl Erb, Alisa Hove

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Interspecific coprophagy is a little-studied phenomenon that has the potential to affect individual fitness by altering gut microbial communities. Lagomorphs (rabbits, hares and pikas) are coprophagous, and pikas have been shown to cache and ingest the feces of other species. American pikas (*Ochotona princeps*) occupy rocky habitats often shared with yellow-bellied marmots (*Marmota flaviventris*). Both species are generalist herbivores, but marmots are hibernating sciurids while pikas, which do not hibernate, rely on cached vegetation (haypiles) for winter survival. Sometimes pikas add marmot scat to these haypiles. One hypothesis to explain this behavior is that pikas gain beneficial microbes from marmot scat. Given their niche similarity, life history differences and the potential for interspecies coprophagy, we sought to compare pika and marmot microbiomes. We characterized gut microbial communities in marmot and pika scat collected in August 2022 from pika haypiles in the La Sal Mountains, UT. We extracted DNA from six paired marmot-pika fecal samples and one unpaired marmot sample using the Qiagen Power Soils Kit. We targeted and amplified the V4 subregion of the 16S rRNA gene. Extracts with successful amplification were analyzed using next-generation DNA-sequencing. For each sample, we calculated OTU richness and other indices of biodiversity (e.g., Shannon-Wiener). We used ordination analyses to examine gut microbial community overlap between pikas and marmots. Analyses are in progress and results will be shared at the conference. This research provides insight into the relationship between pika and marmot microbial communities, deepening our understanding of ecological interactions between sympatric alpine herbivores.

119 - Introductions of chukars (Alectoris chukar) in the United States

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Understanding the historical dynamics of introduced species can be useful for management as well as providing insights in invasion ecology. The Chukar (*Alectoris chukar*) has been introduced to at least 42 states. As a result of these efforts, Chukars have become established in ten states in which they have been released. Successful establishment could depend on species characteristics, habitat characteristics, and introduction effort. Modeling species presence-absence as a function of environmental variables is one approach to address the importance of habitat. We used five modeling techniques: artificial neural networks; gradient boosting; generalized linear models; random forests; and support vector machines. We collected data on site-level factors relating to physiography, climate, land-coverage type, and habitat range to understand introduced Chukar habitat needs and predict new locations that could support Chukar populations Our ensemble model was constructed via a weighted linear combination using the best architectures for each individual model, and produced an AUC of 0.967, sensitivity of 0.85, and specificity of 0.937. Three bioclimatic variables (associated with seasonal precipitation, and temperature variability) and maximum slope were the best predictors of successful establishment.

120 - Spatial and abiotic effects of urbanization on small mammal communities

Brianna Casement, Leslie Lopez, Nicholas Green

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Urbanization is known to decrease the richness and abundance of native wildlife populations, fragment natural areas, and increase human and human-commensal animal interactions with wildlife. Dynamics of species persistence in habitat fragments is often understood in the framework of island biogeography theory (IBT), with habitat fragments being analogous to oceanic islands. However, urban environments present different challenges to dispersal and persistence than literal oceanic islands, so the applicability of IBT to urban ecology is unclear. We investigated how small mammal communities respond to spatial and environmental factors associated with urbanization. These communities are important to consider in urban fragments because of their roles as prey animals, seed dispersers, and their potential to transmit viruses and parasites to humans and human-commensal animals. We trapped small mammals at 23 sites along an urban-to-rural gradient centered in Atlanta, Georgia, USA from May-August 2023. Sites were characterized by in situ environmental conditions such as temperature, ambient light, vegetation, and sound; additionally, we obtained landscape-level data on human population, land use, and socioeconomic variables from public databases. We integrated these data using geographic information systems (GIS) and modeled species richness and other community metrics using generalized linear models. Our preliminary conclusions are that small mammal communities differ between urban, suburban, and rural locations; that these differences are driven by the presence or absence of a small number of species; and that land cover surrounding sites had little impact on small mammal community structure. Further analyses will investigate how spatial, environmental, and socioeconomic factors affect small mammals in urbanizing landscapes.

121 - Above and Below Ground Community Structures in a Longleaf Pine Restoration Site: Dominant Herbaceous Species and Their Soil Bacterial Microbiomes

Isabella Vahle, Paula Jackson

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The longleaf pine (Pinus palustris Mill.) ecosystem is one of the most diverse and endangered temperate ecosystems in North America. The native herbaceous species serve as fuel for the low-intensity, recurring fires the system depends on and thus play a major role in

the maintenance of ecosystem structure. Soil microorganisms, such as bacteria and fungi, are known to aid greatly in many plant processes, including nutrient and water acquisition, resistance to infection, decomposition, and nutrient cycling. However, little is known about the relationship between dominant herbaceous species and soil bacterial compositions within montane longleaf pine ecosystems. In this preliminary study, we completed a multiyear, seasonal analysis of the soil bacterial microbiome composition upon removal of the two most dominant herbaceous species in a longleaf pine restoration site. The objective was to identify the major soil bacterial taxa and establish if changes occurred in their community structures following above-ground community manipulation. We also wanted to investigate relationships between bacterial community structure and environmental factors. Six randomized blocks (2.4m2) were established at Sheffield Wildlife Management Area in Paulding County, Georgia. Each block contained four subplots (50cm2), each with one of the following treatments: 1) control; 2) most dominant herbaceous species removed; 3) second most dominant herbaceous species removed; 4) soil disturbance: no species removed. DNA was extracted from soil samples from subplots each season and PCR amplified for bacterial gene sequences. Preliminary results indicated that the most abundant bacteria were Proteobacteria, Acidobacteria, and Actinobacteria, and soil bacterial relative abundances changed with plant removal and seasons. This information will serve as baseline data for future studies focused on the intricate relationships between ecologically important plants and their equally important microbial symbionts. Understanding these relationships will help inform the restoration process.

122 - Host selection in Harper's Dodder, a rare parasitic plant.

Will Freyberger, Joel McNeal

Kennesaw State University, Kennesaw, GA

Cuscuta harperi (Harper's Dodder) is a rare parasitic vine lacking roots and leaves that is endemic to hot, dry outcrop habitats. Cuscuta species find appropriate host plants by following gradients of specific volatile organic compounds in the air emitted by other plants and growing towards appropriate hosts or away from unsuitable species. Geographically separated populations of C. harperi exhibit drastically different host usage from each other, and we aim to determine whether these observed differences are due to differential responses to volatile chemicals, survivorship after host attachment, or other environmental factors such as timing of parasite germination. We will use greenhouse experiments to compare behavior in host choice between specialist and generalist populations and to investigate whether different populations have differential seedling attachment success across multiple potential hosts.

123 - Relationships between microhabitat-scale land cover measurements and the abundance of woody debris with fish abundance and diversity in streams in the South Carolina Piedmont

Dennis Haney, Lexi Thota, Gregory Lewis

Furman University, Greenville, SC

Prior research has suggested that rural headwater streams in the South Carolina Piedmont often possess lower diversity and greater homogeneity of fish populations than would be expected for streams with minimal urban impacts. One possible explanation for these observations relates to current rural land use or land cover. However, watershed-level measures of current land cover poorly relate to fish abundance and diversity. As such, we examined the hypothesis that localized, microhabitat-scale land covers better explain the distribution patterns of stream fishes than does watershed-scale land cover in the SC Piedmont. Thus, in this study we focused on the relationships between localized riparian zone habitat characteristics and the abundance of woody debris and benthic particulate organic material in the streams with fish abundance and diversity. At each stream site (n=17) we collected fish in 3-4 reaches categorized as riffles, runs, or pools. Within each reach we counted and measured all individual wood pieces and wood piles, determined the proportion of benthic organic material (BOM), and made a variety of riparian and stream habitat quality measurements. An index of biotic integrity along with fish abundance and species richness were significantly positively correlated with mean BOM and the number of pieces of large wood and number of wood piles, along with wood that collected leaf litter. Both stream habitat quality, as determined using the Quality Habitat Evaluation Index, and total benthic fish abundance were significantly positively correlated with riparian zone canopy cover. Wood that helped form pools was significantly positively correlated with species richness and centrarchid abundance but negatively correlated with cyprinid abundance. These results were observed even when the land around the stream was predominantly cropland, pasture/grassland, or had small amounts of urban development, suggesting that microhabitat-level land covers may indeed better explain abundance and diversity of stream fishes in this region.

124 - Comparison of microplastic abundance in environmental samples depending on sample collection and preparation techniques

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The prolific use of plastics in society has led to an excess of plastic waste, which is not biodegradable. Instead, plastics degrade into continuously smaller particles over time. Microplastic particles (≤ 5mm in size) are known to be an environmental and public health concern. Quantification of microplastics in environmental samples, however, is challenging because of inconsistent methodology resulting from small microplastic particle sizes, inconsistent field sampling, cross contamination, varying techniques used to separate microplastic particle from samples, and different counting techniques between laboratories. The results presented from our study aim to identify the best suited techniques for performing microplastic quantification in environmental water samples. Two water sampling techniques were employed during this research, including singular grab samples from the middle of the stream at the surface and multiple grab samples at specific depths and lengths across the stream. These samples were then processed using three different quantification methods published in the literature. Microplastic particles were removed from the water samples by 1) a saltwater density separation method, 2) a single filtration method that involved evaporation of the sample followed by the addition of hydrogen peroxide, and 3) a

double filtration method involving a digestion using hydrogen peroxide. All samples were treated with Nile Red dye and imaged using fluorescence microscopy with a (wavelength) laser within 36 hours of being dyed. Photomicrographs collected on the microscope were stitched together to create high-resolution photomicrograph mosaics, which allowed for counting the fluorescing microplastic particles. The results of each method were compared to the differences between the water sampling techniques and quantification methods to find the best quantification methods to use when sampling small streams.

125 - Latitude and community robustness primarily predict invasion probability of three widespread, invasive plants in Mississippi lakes.

Samuel Schmid, Gray Turnage, Gary Ervin

Mississippi State University, Miss State, MS

Freshwater ecosystems are critically important ecologically and the majority of surface freshwater in many states is found in small lakes. Despite their importance and prevalence, small lakes receive lower research and management effort than larger reservoirs. Aquatic macrophytes are essential components of small lake ecosystems as they are primary producers that provide animal food and habitat, and substantially affect water quality. In Mississippi, small lakes are important natural resources for humans and wildlife, but prior to 2017, no statewide survey efforts were undertaken to survey the aquatic macrophyte communities of small Mississippi lakes. The objective of this study was to use macrophyte community data from state-wide lake surveys since 2017 to determine which landscape factors best predict invasion probability of three aquatic invasive plants: *Alternanthera philoxeroides, Panicum repens,* and *Triadica sebifera*. Surveys of small Mississippi lakes were conducted in the summers of 2017, 2019, 2020, 2022, and 2023. Surveys were conducted using littoral point sampling which yielded presence/absence data of macrophyte species in the littoral zone of lakes. Three plant community metrics - α-diversity, point richness, and littoral fraction (the vegetated proportion of the littoral zone) - were combined into a principal component we refer to as "robustness". Robustness and four other environmental and geographic factors (latitude, longitude, lake area, and secchi depth) were used as factors to predict presence of the three target invasive species. Predictors were fit to response variables using logistic generalized linear models with logit functions. Best-fit models for presence of the three target invasives included only robustness and latitude as predictors. These models help explain what characteristics increase the risk of invasion by common aquatic invasive plants.

126 - Endemism, Ecology and Evolutionary History of the Florida pondweed (Potamogeton floridanus)

Kaitlyn Sampson, Laura Frost

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The Southeastern United States is a biodiversity hotspot and exhibits high endemic biodiversity. Rates of endemic species diversity for aquatic macrophytes in Gulf Coast states are among the highest in the world, on par with tropical ecosystems. Preservation of this biodiversity relies heavily on a detailed understanding of the taxonomy, distribution, ecology, and evolutionary background of species. However, because endemics maintain small population sizes, occur in restricted geographical ranges, or both, they are often grossly understudied and undercollected. This is especially true in aquatic plants as collection efforts tend to be biased towards terrestrial species. Pondweeds (Potamogetonaceae) directly contribute to endemic diversity and support broader freshwater biodiversity by providing food, shelter and habitat for insects, snails, fish, turtles, and waterfowl. The critically imperiled, potentially hybrid, Florida Pondweed (*Potamogeton floridanus*), endemic to coastal blackwater rivers, is of federal interest, but not enough is known of its biology to adequately assess the species for conservation. Previously known only from a few populations in Santa Rosa County, Florida, my work with morphologically similar specimens collected in Baldwin County, Alabama suggests the species is more widespread. Using genetic tools, spatial analyses, and water quality data, this study aims to (1) test the hypothesis that *P. floridanus* is a hybrid, and (2) identify factors that are contributing to the endemism of *P. floridanus.* By doing so, we can potentially expand the known distribution of *P. floridanus*, identify other potentially suitable areas, and examine environmental tolerances to fill knowledge gaps for the ecologically important but understudied Florida Pondweed.

127 - Effects of tree shelters on tree seedling microclimate and seedling chlorophyll production: two-year results

Christina Henriksen, Bruce Wiggins, Emmaline Clark, Elizabeth Stanley, Owen McDonald, Kiley Plum, Alexander Busch, Skyler Reese

James Madison University, Harrisonburg, VA

Matured riparian forests buffer streams and rivers downslope from the effects of upslope land use by improving water quality and providing carbon sequestration. Riparian forests also protect land upstream by minimizing the impacts of flooding and high winds. Restoring riparian forests has long been considered an agricultural best management practice as large-scale agricultural use intensifies nutrient loading into streams and causes a decline in water quality. There are many methods of riparian forest restoration, but the focus of this study is evaluating the practice of restoring planted trees using plastic tree shelters. Studies suggest trees within un-ventilated shelters benefit from elevated temperature and humidity while other studies indicate adding ventilation (holes) to shelters may result in the accumulation of more biomass than trees grown in un-ventilated shelters. The purpose of this study is to quantify the effect of ventilated shelters on seedlings. In the spring of 2022, 162 tree seedlings (*Liriodendron tulipifera*, *Platanus occidentalis, Amelanchier canadensis,* and *Asimina triloba*) were planted on an active cattle farm in Linville, VA. Seedlings were planted in ventilated and non-ventilated tree shelters. Field data were collected in the spring of 2022 for height and diameter and again in the fall of 2022 and 2023. Internal tree shelter temperature and relative humidity was collected three times throughout the growing season in 2022 and chlorophyll content was collected at the end of the summer in 2023. Results demonstrate seedlings grown in unventilated shelters develop significantly less chlorophyll (p-value <0.001) and experience higher overall relative humidity ($p<0.05$), than seedlings in ventilated shelters. No significant differences in height, stem diameter, or shelter temperatures were found. Correlation between internal shelter

climate, shelter type, and plant health could potentially lead to the development of more specific guidance when creating riparian restoration planting plans which utilize protective tree shelters.

128 - Lineage Directed Microeukaryote Metabarcoding of Eustigmatophytes and Cryptomonas

Bruce Cahoon[1], Marvin Fawley[2], Karen Fawley[2], Lucy Hornberger[3], Isabella Maggard[1], Robin Matthews[4]

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Large scale eDNA metabarcoding surveys using "universal" primer sets such as the V4 region of the 18S ssu RNA gene have allowed phycologists to compare diverse aquatic habitats and answer broad questions about the presence/absence of many microalgal lineages and their ecology. Unfortunately, surveys using only 18S primers under-identify or completely miss some microalgal lineages. Data from two studies will be presented, one using primers targeting Eustigmatophytes, the other targeting *Cryptomonas*. In both studies samples were collected from bodies of water in Southwestern Virginia and attempts made to identify as many of each group as possible using 18S primers versus lineage-directed primers. For the Eustigmatophyceae, primers were designed to target the plastid *rbcL* gene and produced a 370bp amplicon from all known lineages. Use of this marker enabled the recovery of 158 distinct Eustigmatophyte sequences from our samples and could distinguish Eustigmatophyte lineages in a Maximum Likelihood phylogeny. In comparison, 7 distinct Eustigmatophte sequences were recovered from the same samples using the 18S marker. For *Cryptomonas*, primers were designed to target the nuclear rRNA ITS2 region which produced amplicons ranging from 251 – 488 bp that could distinguish known *Cryptomonas* species equally as well as much longer nuclear ribosome markers. For this study a single small ephemeral pool was sampled over the course of a single spring-summer-fall and 13 distinct *Cryptomonas* species were recovered using the ITS2 targeted primers. In comparison, 6 Cryptomonas sequences were recovered using the 18S marker and a single *Cryptomonas* sp. was recovered using a culture-based approach.

129 - Allopatric Speciation Affecting the Former Crayfish Subgenus Jugicambarus Color Morphs

Jaden Rusnak[1], Zachary J. Loughman[2], Zackary A. Graham[2]

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The phenomenon of conspicuous coloration in Appalachian burrowing crayfish, particularly with the *Cambarus aff. dubius* complex within the former subgenus of Jugicambarus, intrigues many researchers. While traditional theories like natural and sexual selection offer some explanations, the underlying reasons for the bright color patterns remain inconclusive Previous studies suggest the coloration may be linked to the habitat of primary burrowing crayfish, with elevation gradients playing a critical role in the evolution of the color morphs. Due to the burrowing crayfish's restricted dispersal capabilities, the limited gene flow between disjunct populations indicates allopatric speciation as the main driver of the diverse color patterns. Geographic barriers and varying elevations coupled with the distinct environmental conditions of the Appalachian Mountains may contribute to the development and distribution of different color morphs among primary burrowing crayfish. The data from this study represents known observations of conspicuously colored Jugicambarid crayfishes and categorized them based on their color morph using verifiable photos. The photos and locations were taken from previous *C. aff. dubius* collection efforts and iNaturalist records. The compiled data was used to generate a map that illustrates the color distribution among Jugicambarid crayfishes, offering insights into how geographical barriers might impact the color evolution. We also conducted an analysis to determine if one the most widespread species, *C. aff. dubius* exhibits a phenotypic cline in coloration throughout their range.

130 - The Effects of Abandoned Mine Drainage on Breakdown Rates and Benthic Microbial Composition in an Appalachian Stream

Katherine Cutlip, James Wood

Department of Organismal Biology, Ecology, and Zoo Science, West Liberty University, West Liberty, WV

Freshwater ecosystems are an integral resource in the breakdown, sequestration, and release of carbon into the environment. Polluting aquatic ecosystems alters water chemistry and rates of decomposition (breakdown), reduces biodiversity, and can lead to toxicity, impairment, and eutrophication. Abandoned mine drainage (AMD) is one source of freshwater pollution commonly found in the Appalachian Mountains of West Virginia. I selected a stream with an accessible AMD input located halfway through its run, to compare differences in water chemistry, breakdown rates, and microbial community structure and composition. Five locations were selected (2 above and 3 below the AMD) and arrays containing cellulose sponges and wooden veneers were deployed for five weeks. Water samples were collected from the AMD drain tube and from each location for cation and anion analysis, and weekly water chemistry readings were taken at each location during array deployment. After five weeks the arrays were collected, and the substrates separated by location and substrate type. A portion of the substrates were used to determine breakdown rates while the rest were used to identify microbial communities. The rate of breakdown was calculated for each substrate type at each location. DNA was isolated and sequenced by substrate type and location to identify the fungi and bacteria present within the microbial communities. Water chemistry, breakdown rate, and microbial composition were compared site to site, as well as pre- to post- mine drainage input. Preliminary results indicate the presence of AMD significantly reduces the breakdown rates of labile and recalcitrant carbon materials and alters the microbial community structures and compositions found in stream sediments.

131 - Investigating the Influence of Spatial-Temporal Scale on Thalassia testudinum Communities Throughout the Caribbean Basin.

JR Kerfoot, Michael Schiebout

Union University, Jackson, TN

As alteration of natural ecosystems in coastal areas increases, the ability to identify the spatio-temporal extent of changes and ecological degradation is paramount in determining best management practices. Various locations throughout Florida have seen a severe reduction in once dense seagrass communities. However, this decrease in seagrass cover has not occurred equally across the Caribbean basin. The goal of this project was to model the fluctuations in *Thalassia testudinum* (turtle grass) percent cover at various spatio-temporal scales (local, regional, and Caribbean basin-wide; monthly and annually) to identify potential environmental drivers of those systems at scale. *Thalassia testudinum* percent cover was measured mostly bi-annually at established transects in Jobos Bay National Estuarine Research Reserve (JBNERR; Puerto Rico), Charlotte Harbor Aquatic Preserve (CHAP; Punta Gorda, FL), and Rookery Bay NERR (RBNERR; Naples, FL) between January 2019 – December 2023. Additionally, environmental parameters such as temperature, pH, light, depth, and dissolved oxygen were measured at transects. Akaike Information Criterion models were developed to explain *T. testundinum* percent cover across spatial scales. Models were developed using combinations of environmental parameters, community structure (macroalgae abundance), and temporal scale. Caribbean basin-wide, the best explanatory model of *T. testudinum* cover included the seasonality, turbidity, temperature, pH, and light levels. At regional scales, the best explanatory models of cover for southwest Florida sites (CHAP and RBNERR) included turbidity, dissolved oxygen levels and macroalgal abundance, whereas sites in JBNERR included dissolved oxygen, temperature, and annual variability. At the local scales, there was variability in the components of the best explanatory models by location with some showing an influence of seasonality, with others including macroalgae abundance, and still others showing an annual variation impact on cover. As professionals assess the best management practices for seagrass management/restoration, the influence of scale must be considered in the development of those practices.

132 - Diving into the applicant pool: A first-year professor's anecdotal insight for navigating the faculty application process

Alexander Orfinger

Dalton State College, Dalton, GA

Most life sciences PhD students in the United States list a tenure track faculty position as their first career choice, yet fewer than 10% ultimately end up in a tenure track position. This is coupled with the fact that faculty mentors and peers frequently steer graduate students towards seeking a faculty position. Despite the pressure put on graduate students to land a faculty position, most receive little to no formal guidance on best practices in finding, applying to, and interviewing for these positions. Based on my recent successful job search comprising 37 applications, I present anecdotal advice for graduate students and postdoctoral researchers who are considering pursuing faculty positions. Mirroring my personal goals and job search activities, my talk places special focus on teaching-forward positions with opportunities for research, and will highlight tools for finding open positions, tips for formulating cover letters, teaching statements, and research statements, and guidelines for the virtual and in-person interviews. Given the very limited time available relative to the wealth of relevant information involved, I encourage those wanting to talk more about the process to contact me for more in-depth and broader discussion.

133 - Inquiry-Based Formative Assessments Improve Preprofessional Learning of the Musculoskeletal System

Felicity Sterling

Belmont University, Nashville, TN

Memorization of the musculoskeletal system is a hallmark of preprofessional undergraduate anatomical education. Traditional lesson plans involve extensive open lab time focused on memorization techniques with some including didactic lectures focused on isolated regions of the body. These methods have been shown to decrease student satisfaction, confidence, and retention. Current research promotes inquiry-based methods to improve student learning, particularly within STEM courses. However, such methods have yet to enter entry-level anatomy laboratories. As such, we generated a new laboratory activity that employs common pain patterns to teach boney landmarks, muscle names, and muscle origin, action, and insertions (OIA). Observations during practical examinations revealed that the inquiry-based cohort adapted their learning towards application over memorization which resulted in significant improvement in overall understanding of the musculoskeletal system and overall higher scores on practical examinations in comparison to the previous Human Anatomy and Physiology cohort.

134 - Demystifying the black box of sequencing: incorporating Minion sequencing of chloroplast genomes in the classroom

Tyler Gandee

James Madison University, Harrisonburg, VA

Over the past decade, the ability to collect and interpret genomic data has become more accessible with lowering sequencing costs and increased availability of bioinformatics programs. Allowing the implementation of these technologies within a classroom setting teaches students about sequencing and bioinformatics. However, students in most of these classes are missing a key component of this process as it's common to send genomic samples extracted or collected to a company for sequencing. This practice results in a disconnect for students, where sequencing has become a black box that is taught, but rarely seen or done within the classroom. The thought has persisted

that using sequencing in the classroom will lead to a better understanding of these modern technologists. Through the use of Oxford Nanopore's MinION sequencer, we have created an undergraduate module that allows students to interact with a sequencer and observe real-time sequencing. The MinION has previously been implemented in classroom settings before but primarily in smaller, upper level courses. For this project our goal was to implement the MinION on a larger scale and implement a module in an undergraduate lab course. The module was piloted in eight lab sections during the 2022-2023 spring semester and fully implemented in ten lab sections during the 2023-2024 fall semester. Surveys were conducted to assess the impact, comparing students who interacted with the sequencer to those who did not. After the module was taught, surveys were given to all students involved, and asked a variety of questions about the module to see if there was a significant difference between students who had the sequencer and students who didn't. By bringing sequencing to the classroom we have bridged the gap between scientific data collection and analytical process.

135 - Perceptions of conflict between religion and evolution are higher among atheist undergraduate biology students than Christian biology students

Katie Coscia[1], Rahmi Aini[1], Chloe Bowen[1], Sara Brownell[2], Elizabeth Barnes[1]

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The perceived conflict between evolution and religion can drive rejection of evolution among highly religious students, which has led to research on how to reduce these students' perceived conflicts. However, perceived conflict and its potential consequences have not been explored among non-religious undergraduate biology students. Interestingly, recent research shows that in the public, perceived conflict between religion and evolution is higher among non-religious populations than religious populations. While high perceived conflict among non-religious biology students might not influence their acceptance of evolution, it may influence these trainees' ability to communicate effectively about evolution to their future students, patients, or various other populations that they communicate with. We developed a novel measure of perceived conflict between religion and evolution that functions for both religious and non-religious biology students and administered it to over 11,000 undergraduate biology students in fourteen states. Results showed that atheist students had higher perceived conflict levels and lower perceived compatibility levels than their Christian peers. To determine why atheist students perceived conflict between religion and evolution, we examined open-ended responses from atheist students. Central themes found in our analysis included that students who saw conflict tended to conflate their own atheistic views with the scientific viewpoint and those who saw compatibility tended to see clearer boundaries between religion and science. The implications of these findings are that non-religious undergraduate biology students who perceive conflict between religion and evolution could transmit their views that an atheistic viewpoint is the official scientific viewpoint to their peers and future students. Evolution instruction that acknowledges potential compatibility has been shown to help religious students perceive less conflict, so future research should explore whether this instruction could reduce conflict among non-religious students, which may help them promote potential compatibility when they communicate about evolution in their future roles.

136 - Use of Team-Based Learning and Alternative Grading Systems in Biology Courses to Promote Learning Engagement, Employment Skills, and Increased Equity in the Classroom.

Darla Wise

Concord University, Athens, WV

Team-based learning has been noted to increase student engagement, facilitate student collaboration, and promote skills associated with independent learning, self-confidence, leadership, and working as a team member. Rather than focusing on grades earned, alternative grading systems focus on the content and the student's ability to thoroughly respond to an assignment prompt. To assist in reviewing content before the first class, textbook readings, supportive videos, and scaffolding questions were provided and students responded both individually and discussed as a group. Analysis in the form of student responses and classroom demographics were examined over ten years (both with and without the use of team-based learning and alternative grading) to examine equity. In this study, the combination of team-based learning and alternative grading methodology aided in adding both motivation for life-long learning and the development of employment skills, such as team building, self-confidence, and leadership.

137 - Collaboration between secondary and college educators to meet state education standards

Amy Allen[1], Chris Havran[2]

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Most high school students have a hard time viewing themselves as a scientist post-high school. It is important that every student has knowledge of careers in science and the pathway needed to succeed. To achieve this, students must be exposed to these opportunities while in high school. The authors, a high school and college educator, met at the 2023 meeting of the Association of Southeastern Biologists in Winston-Salem, North Carolina. Since then they have collaborated to introduce high school students to a college professor and campus while simultaneously meeting North Carolina state education standards. In May 2023, Chris Havran visited the classroom of Amy Allen at Southern Lee High School to present on his educational background and on a recent taxonomic research project. The presentation was crafted to incorporate North Carolina state standard Bio 3.5: "Analyze how classification systems are developed upon speciation". Students were engaged and asked great questions. In Fall 2023 the collaboration was expanded by incorporating a collections-based lab that began during a classroom visit in October 2023 and concluded a week later when the students traveled to Campbell University. They visited science lab rooms, the greenhouse, and took a campus tour. The success of the classroom and college visits have been evident in student response and understanding of content covered throughout the sessions. We are doing our students and the science community a disservice by failing to show them the opportunities available to them in the sciences while in high school. A mutual goal of high school and college educators is to inspire students to become future scientists. High school-university partnerships

allow faculty to experience high school educational standards and students to see the real life applications and clear pathways to achieve their goals.

138 - Reflection and Synthesis: A Senior Capstone Seminar for Biology and Related Majors

Jennifer T. Thomas

Belmont University, Nashville, TN

Capstone courses are a common ending experience to an academic program in higher education. Although many capstone courses focus on a culminating project in a student's area of study, Belmont University's Senior Capstone course emphasizes reflection to tie the student's *general education* experiences over four years together. To further support our majors and their unique perspectives as developing scientists, we designed a senior capstone course for only Biology, Environmental Science, and Biochemistry & Molecular Biology majors. The objective is to still allow reflection on their general education courses, but also examine how these experiences *inform* their goals as future educators, researchers, and healthcare providers. This presentation will detail the course structure, reading choices, and assignments, as well as provide early feedback from students.

139 - Development of a shared definition of inclusive teaching in STEM: a first step towards implementation and evaluation of inclusive and effective teaching.

Clay Runck, Allison D'Costa, Latanya Hammonds-Odie, Sonal Dekhane

Georgia Gwinnett College, Lawrenceville, GA

Significant gaps exist between students of color and white students in rates of retention, progression, and graduation in STEM degree programs. Reasons often cited for these equity gaps include financial, socioeconomic, academic preparedness, and sense of social belonging. Sense of belonging is perhaps the one factor that STEM faculty can directly impact through their course design and the teaching pedagogies they use, such as incorporation of inclusive teaching practices (ITPs), which benefit all students, regardless of race, ethnicity, gender, socioeconomic background, or disability. Many STEM faculty receive little to no formal training on teaching during their advanced-degree program and are hired primarily for their content/research-area expertise. Georgia Gwinnett College is a teaching-focused, 4-year undergraduate institution with a remarkably diverse student body. GGC faculty members are committed to effective teaching practices to support the learning of such a diverse student body, but they have not received formal training on ITPs. It is likely that many are using some ITPs without knowing they are doing so, therefore training on ITPs and how their consistent use can contribute to a student's sense of belonging and student retention is vital. In 2022, GGC was awarded a HHMI Inclusive Excellence 3 grant with the challenge to *meaningfully evaluate inclusive and effective teaching*. Our first step in this challenge was to develop a shared definition of inclusive teaching for the School of Science and Technology (SST). We implemented a multi-step process that gave all SST faculty members the opportunity to review and provide input and feedback at various stages during the development of the shared definition. We will describe the process we used and present results for faculty buy-in, active participation, and personal awareness of ITPs, as well as drafts of the inclusive teaching definition at different stages in the development process.

140 - A Culturally Responsive Pedagogy for Sustainability and Environmental Science Engagement: Intersecting Ecosystem Services and African American Settlement in the Southeastern United States.

Mark Dugo, Erika Dugo

Johnson C. Smith University, Charlotte, NC

This presentation introduces an exploratory science education research exploring aspects of motivation theory to increase the participation of African Americans (AAs) in sustainability and environmental sciences, and to improve stakeholder engagement in the environmental sector. Spatially, we focus on a regional placed-based scope that spans across the Southeastern United States. Our student engagement is intentionally framed within the ecosystem services framework and seeks to awaken social and environmental justice agency. AA values, identity, and interest are reflected upon- as a means to motivate environmental engagement. Cultural connections and socio-environment interrelations are underscored while the conservation of biodiversity is highlighted as a requisite for the continued delivery of ecosystem services. The intervention strategy considers persistent poverty among predominantly rural AA populations in the SE US in the context of African descendant people's original settlement in this region. Pre and Post survey data results indicate a significant shift in perceptions regarding historical ($P<0.05$) and modern ($p<0.05$) social biases as constructs that discourage AA engagement in environmentally related STEM disciplines. The intervention also increased student's perceptions on the importance of biodiversity ($p<0.05$). Finally, student's post intervention survey results indicated strong agreement that the ecosystem services framework: resonates positively with the historical identity and culture of AA's, and is a useful lobbying platform when advocating for capital investment as a "*reparations proxy*" for predominately AA communities that remain in persistent poverty. These initial findings and additional qualitative data that will be discussed during this presentation are encouraging and warrant further study.

141 - Give a Hoot: an owl case study in the power of citizen science audio data for natural history research and teaching

Daniel Albrecht-Mallinger

Virginia Commonwealth University, Richmond, VA

Over the last decade, an explosion of citizen science programs has generated an unprecedented wealth of data for research and teaching in natural history, biodiversity, and conservation. However, the "messiness" and sampling bias endemic to these data often constrains their potential for analysis and pedagogy: observations are overwhelmingly generated in regions of high human density and for

organisms that either capture human interest or are easy to photograph. Audio records of species offer a unique–and underutilized–opportunity to leverage citizen science data for meaningful natural history scholarship by focusing inquiry on specific behaviors (e.g., territorial calls, mating song) and the environmental contexts in which they are or are not observed. Here, I present a case study in the potential of audio citizen science data for undergraduate research and learning. I use research-grade acoustic observations of North American owl species from 2020-2023 on iNaturalist along with open-source R packages to introduce students to basic practices in data science (e.g., data types, distributions, workflow management) and testing behavioral hypotheses (e.g., does lunar phase affect call frequency for different owl species?). If accessible and tractable, similar citizen science audio datasets can inform research direction and project design for scholars of animal behavior and conservation, irrespective of their career stage.

ASB Posters

P1 - The Effect of Music Therapy on the Concentration of College Students

Jennifer Tellez-Chavez, Marissa Young, Joni Criswell

Anderson University, Anderson, SC

Students are always looking for ways to improve their studying tactics, especially college students. Previous studies in the medical field have shown the effect that music therapy has on the consciousness of individuals, this research is to determine whether this effect stands true when manipulating the minds of college students during mental tasks. In this research we had four musical stimuli (upbeat lyrical, upbeat instrumental, calm lyrical, and calm instrumental), with the addition of a control group, that paired with a mental task. This mental task was a mad math multiplication worksheet, students had one minute to attempt in completing the worksheet. While the experiment was taking place, a Muse EEG headset was worn to show the participants brain waves. We collected the data from each of the five brain waves: Delta, Theta, Alpha, Beta, and Gamma. A One-Way Repeated ANOVA Measures Test was done with the data collected from the EEG headset. We found that the calm instrumental musical stimuli (Serenade in B-Flat Major by Mozart) is the most effective by showing the highest concentration of beta and gamma brain waves. Serenade in B-Flat Major by Mozart also exhibited a significant difference when compared to the other three musical stimuli and the control group.

P2 - Does Social Organization, Litter Size, Sexual Dimorphism, and Phylogeny Influence Multiple Paternity in Mammals?

Madison Roberts[1], Loren Hayes[1], Stephen Dobson[2]

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Animal social systems are complex and the dynamics of one component could influence the dynamics of another. The aim of this literature search research was to determine the interrelatedness between mammalian social organization and mating system, two components of social systems. The mating system was represented by multiple paternity, the number of litters with more than one father, as genetic analysis tells which individuals reproduced with who. Variables that might influence multiple paternity amongst extant mammalian species included in this study are variable social organization, male social organization, mean litter size, sexual dimorphism, and phylogenetics. Analysis was conducted using 56 mammalian species from 97 population that made up 10 orders. The overall mean percentage of multiple paternity across all the male social organizations was 0.39. Analysis relieved that two hypotheses based on the variables above that were important effectors of multiple paternity included male social organization and mean litter size. Of the male social organization units, only multimale single female groups influenced multiple paternity, Multiple paternity was negatively correlated to mean litter size, which is the opposite of what other studies have found. Variable social organization, body mass, and phylogeny were not found to be important predictors of multiple paternity. The negative correlation between litter size and multiple paternity could be explained by mate guarding or improved by analyzing using a more holistic model. The statistical power of male social organization could be improved by creating less categories of male units as either multimale or single male. Other variables of interest to multiple paternity could be social structure, breeding season length, and environmental data. This study encourages the use of quality data and more natural history studies of animals.

P3 - The Effect of the Visual Sensory Response on Memory and Retention

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This study investigates the impact of specific light wavelengths on memory and retention in college-aged students. Prior research indicates that exposure to varied light wavelengths aids memory retention and stress reduction in individuals with memory-related disorders. The collected research aims to explore how visual sensory responses to light influence academic focus and performance in young adults, with the goal of identifying potential benefits for enhancing cognitive abilities and academic achievement. Overall findings revealed college-aged students demonstrate enhanced academic performance under white light, excelling in both question completion and correct answer averages.

P4 - Sex Differences in Head Scanning Behavior in Long-Evans Rats in the Cue-Mismatch Task

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Long-Evans rats have been used in spatial learning and memory tests since the 1980's. Nearly all experiments have been conducted solely on male Long-Evans rats, and those that have used both sexes, or only females, are limited in number and in methods. The majority of these studies have been performed with either water mazes, such as the Morris water maze, or a few select other tasks, such as the radial arm maze. Studies using the cue-mismatch task, a recently introduced method to examine the computational properties of the hippocampus, are largely limited to male subjects. In the studies using both sexes for this task, no measures for sex differences have been performed. Our study used the cue-mismatch task to measure sex differences in laps and head scans performed during the task. Rats use head scans to observe their environments, and the behavior is defined by a rat stopping forward movement and extending their nose past the track. The rats were run for ten days on a track with nine of the days having consistent visual cues placed around the room,

and the tenth day had the cues and track rotated for a combined 90° or 180° difference. For the non-test days there was a significant difference found in average head scan counts performed by males and females, $t(34) = 3.804$, $p<0.001$, with males performing more head scans. There was no significant difference in the number of laps performed, $t(34) = 0.346$, $p=0.731$. The difference in head scans shows that there may be a difference in how females perform on the task compared to males. These data may also indicate differenced attentional properties between the sexes. This could indicate that male and female Long-Evans rats should be considered as distinct groups in the cue-mismatch task.

P5 - The Effect of Physical Sensory Response on Memory and Retention

Gracie Hulsey, Andrew Faircloth, Joni Criswell

Anderson University, Anderson, SC

The objective of this study is to analyze how different physical sensory objects, such as fidget toys, can affect memory and the ability to retain information in college students. Previous research suggests that the usage of 'fidget toys' can help individuals with focus disorders, improve their retention abilities and reduce stress levels. This research aims to examine the impact of physical sensory responses in young adults and how it may affect their academic focus and performance. The ultimate goal is to identify potential benefits of physical sensory objects, 'fidget toys', in enhancing cognitive abilities and academic achievement. Overall, the findings indicate that college students perform better academically when not manipulating physical sensory objects, leading to adequate completion of questions and achieving higher average scores.

P6 - Assessing the Rearing Component of Chick Development in Relation to the Personality of Breeding Tree Swallows (*Tachycineta bicolor*)

Clarice Perry, Lynn Siefferman

Appalachian State University, Boone, NC

Previous research has shown that breeding pairs of Tree swallows (*Tachycineta bicolor*) with similar personalities raise chicks of better condition, but it is unknown if this is due to a genetic factor or distinct parenting styles. We decided to test this question by designing an experiment involving the cross-fostering of Tree swallow chicks between nests of breeding pairs, and seeing how their condition varied at fledging age. Tree swallows are a species of secondary cavity-nesting passerines that frequently select artificial nest boxes as their preferred nesting site, thus making them a convenient and accessible species to study. Data was collected May through August of 2021 in Watauga County, North Carolina. When chicks were between 2 and 5 days old, we switched chicks between nests at random in order to remove the genetic component of chick rearing. We tested nesting Tree swallows' responses to simulated predatorial intrusions to estimate their levels of aggression by setting up a model crow above the nest box at certain stages of the chick development. We then compared this data against the corresponding chicks' measured mass at ages 2, 5, 8, 11, and 14. Our results did not show a statistically significant effect of parent personality on chick development.

P7 - A gene encoding a nicotinic acetylcholine receptor subunit, *acr-6*, is required for ethanol and nicotine state dependent learning in *Caenorhabditis elegans*

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Learned behaviors allow organisms to process stimuli in order to make adaptations to their environmental surroundings. A specific behavior, known as state dependent learning (SDL), occurs when recalling a learned behavior is more effective when the internal state of the organism is consistent during learning and recall. A variety of model organisms demonstrate SDL including goldfish, rodents, lower nonhuman primates, humans, and the nematode model *Caenorhabditis elegans* (*C. elegans*). Though this behavior has been investigated for several decades, little is known about its mechanism. To demonstrate SDL in *C. elegans*, we combine exposure to substances while testing for olfactory learning. Olfactory learning is a learned behavior that occurs when a diminished response to an odor is observed upon subsequent exposure to the same odor. When worms are kept in the same intoxicated state during learning and recall, no loss of olfactory learning occurs. Shifting state from learning with substance exposure to recall without substance exposure shows a loss in performance in olfactory learning. This loss in performance confirms SDL. Previous work with *C. elegans* shows alcohol causes state dependency and requires the genes *hen-1* and *scd-2*. Here, nicotine also causes SDL in *C. elegans* and requires *hen-1* and *scd-2*. In order to identify other genes required for nicotine SDL, we tested worms with mutants for genes that are targeted by nicotine. Specifically, we investigated a gene that encodes a nicotinic acetylcholine receptor subunit, *acr-6*. We found this gene is required for nicotine SDL and ethanol SDL. Our goal is to test the similarities and differences between SDL conferred by different substances to further our understanding of the state dependent learning mechanism. So far, we have not identified any genes that distinguish the ethanol and nicotine SDL molecular mechanisms.

P8 - The Effect of Human Constructed Pathways on Carabid Beetle Movements

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The ability to connect with other populations is important to all living organisms, this allows organisms to continue to grow and reproduce successfully. As humans we also require the ability to reach other populations in our daily life, and as the population grows we must continue to expand and create more and improved infrastructure. Pathways are created for human needs and wants for quicker

transportation and recreation, but these pathways can lead to separation of populations and fragmentation where organisms are now left more vulnerable to predators. Due to a large amount of research being conducted on larger mammals and the effects of roads and highways, it can be hypothesized that smaller pathways like hiking trails may also have negative impacts on smaller organisms such as Carabids. Carabids are commonly known as ground beetles from the family Carabidae. By using a mark-recapture method and pit-fall traps with Carabids found on three trails with three different widths/terrain, it was determined that the trails were not a barrier due to their short movement patterns.

P9 - The International Frontiers in Social Evolution seminar series: An engaging way to learn about animal social evolution

Loren Hayes[1], Carsten Schradin[2], Adriana Maldonado-Chaparro[3], Eduardo Fernandez-Duque[4]

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The Frontiers in Social Evolution Seminar (FINE) is a remote seminar series that originated during the Covid-19 crisis, when in-person meetings were not possible and a need for exciting talks insatiable. The FINE seminar series is now an established and cost-effective means platform for students and researchers from around the world to discuss social evolution. The FINE meets weekly during two periods – Sept to Dec and March – June. The series has hosted 130 seminars featuring speakers from 20 countries and six continents and spanning taxa from protists to mammals. The FINE format is unique because traditional seminars (45 min) are followed by upwards of an hour of discussion, a method that promotes deep understanding, networking, and a sense of community. We have also produced educational resources including lecture notes for instructors and guidance on how to use FINE seminars in the classroom. Through our Quick-FINE program, students have published short summaries of FINE videos on our YouTube page, increasing their exposure to the scientific community. This poster will highlight the benefits of engagement with the FINE. Information about where to find the FINE seminar will be provided.

P10 - Lycosidae Abundance and Diversity along an Anthropogenic Gradient

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Significant knowledge gaps exist in how land-cover impacts ground-hunting spider populations. To fill these gaps, this study investigates a common family of ground-hunting spiders, Lycosidae, to determine differences in their abundance and diversity in deciduous leaf litter and managed turfgrass (lawn). The study was conducted within a forested ecosystem at Virginia Commonwealth University's Rice Rivers Center in Charles City County, Virginia. I placed 10 belt transects (1m x 20m) on lawn substrate and 10 identical transects in deciduous forest leaf litter substrate. I performed repeated visual census via eyeshine and manual capture of up to three individuals per transect per survey in the July and August of 2023. There was significant difference in abundance between lawn and leaf litter transects, with higher average abundance in leaf litter transects ($p = 0.01$). There was also significant difference in total Lycosid abundance between survey periods (chi-squared = 23.6, df = 3, p = 2.9e-05). There were no significant differences in diversity (Shannon Diversity Index; $W = 68$ and $p = 0.18$); however, several species had significant associations with lawn or leaf litter substrate.These findings can aid in the understanding of human land management on a group of understudied, but abundant and ecologically vital arthropod predators, and suggests further research into the habitat preferences of Lycosid spiders is needed.

P11 - The Gator Chomp: Investigating the Influence of Prey Mobility on Feeding Kinematics of *Alligator mississippiensis*

Victoria Seymour, James Kerfoot

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American alligators (*Alligator mississppiensis*) are apex predators who forage opportunistically for their prey. Within this diverse set of prey, they capture both mobile and immobile prey to survive. Little is known about how alligators modulate their prey capture as it relates to the mobility of their prey. This study investigated the modulation in feeding behavior of alligators when feeding on mobile versus immobile prey. Using six juvenile captive-reared individuals, feeding events were recorded for individuals feeding on both mobile and immobile fish prey using a high-speed video camera in a laboratory-controlled setting. Feeding performance was summarized by analyzing 4 kinematic feeding variables (maximum gape, duration of feeding event, approach velocity, and maximum gape velocity) for each feeding event. Results showed that none of the kinematic variables were significantly different between treatment groups, and that alligators fed equally well on mobile and immobile prey. This indicated that American alligators do not modulate their feeding behavior based on the mobility of the prey. Here, American alligators seem to utilize a static or constant form of prey capture behavior regarding the prey's mobility underwater.

P12 - Alpha Gal Risk Factor Assessment of Ticks in Southwest Virginia

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Alpha gal syndrome is an emerging tick-borne illness caused by the carbohydrate Galactose-α-1,3-galactose which is known to cause red meat and dairy allergies in humans. The severity of alpha gal syndrome may vary between cases, ranging from mild rashes to anaphylactic shock upon exposure to an allergen. Currently, alpha gal is known to be conveyed by *Ixodes scapularis* and *Amblyomma*

americanum species in the United States, though the transmission mechanisms are currently unknown. The recently invasive *Haemaphysalis longicornis* is also a potential risk for conveyance since evidence from other countries has indicated the species can transmit alpha gal. My research has focused on assessing the risk of alpha gal exposure in various locations across southwest Virginia by analyzing the known carrier species. I hypothesized that southwest Virginia is at high risk of alpha gal exposure due to the high density of *Ixodes scapularis* and *Amblyomma americanum* species.

Adult and nymph ticks were collected across various locations using the flagging method, which utilizes a piece of white cloth attached to a pole that can be dragged through grass, leaves, and shrubbery. All collected ticks are stored in ethanol. Across these locations, a total of 1,778 ticks were collected in the year 2022, of which 859, or 48% of the ticks were one of the two known species to convey alpha gal. Additionally, 860 of the ticks were *Haemaphysalis sp* which may also present a risk of alpha gal transmission if confirmed to carry alpha gal in the United States. Southwest Virginia is at a high risk for alpha gal syndrome from tick bites due to almost half of the tick species being known as potential conveyers of the disease and similarly large portion of the species displaying alpha gal globally.

P13 - Impact of Parasitic Blowflies and Habitat Quality on Nestling Songbird Growth

Emily Gillikin, Lynn Siefferman

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Both habitat quality and parasitism can affect the growth and quality of juvenile birds. However, to date, little research has focused on potential interactions between habitat quality and parasitism in songbirds. We studied breeding tree swallows which are small aerial insectivorous songbirds. Nestlings grow to adult body size within 2-weeks of hatching. In songbirds, growth parameters are very good indicators of survival to adulthood. Habitat conditions preferred by swallows are open grassland with less forest. These locations have greater area for aerial insect foraging & greater prey abundance. Swallow nestlings are parasitized by larval blood-sucking blowflies. Past research shows blowflies can reduce growth rates. Although parasites steal energy from the nestlings, nestlings sometimes may be able to overcome by mounting blowfly-specific antibody responses. Mounting such immune responses can be energetically expensive to nestlings, but it can reduce the abundance of parasites. Here, we use two datasets from wild tree swallows breeding in the southern Appalachian mountains to understand the effects of parasites and habitat on nestling quality. First, using correlative field data, we tested interactions between habitat quality and parasitism on nestling growth. We found that more heavily parasitized nestlings grew more quickly but achieved a smaller final size. We found no effect of habitat on nestling growth. These results suggest that nestlings with higher immune response might reduce parasite loads at a cost to their growth. Next, using a field experiment, we applied a blowfly removal pesticide and compared the growth of nestlings from experimental nests with those who had no parasites likely because of immunity. If immunity reduces growth, the control nestling should grow slower. Using this combination of datasets, we hope to understand the impacts of parasites, immunity and habitat on juvenile growth.

P14 - Prevalence of apicomplexan gregarines in flat-back millipedes

Alicia Ellis, River Medina, Nhien Le, Jennifer Zettler

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Eurymerodesmus varius is a species of flat-back millipedes with a range that expands across the Southeastern United States. While commonly encountered, this relatively small species of millipede is often overlooked. In fall of 2023, millipedes were found crawling into buildings on the campus of Georgia Southern University's Armstrong Campus in Savannah and dying en masse. Because parasites are known to elicit behavioral responses in some infected hosts, we dissected dying millipedes and surveyed them for nematode and other potential symbionts. We found a high (> 75%) prevalence of gregarine apicomplexans within the intestines and body cavities of male and female millipedes. We documented at least two species of gregarines at different stages of development living simultaneously within both dying and apparently healthy millipedes. While many gregarines are obligate, unicellular parasites, some species are known to form commensalistic or mutualistic partnerships with their hosts. Future studies will attempt to identify these gregarines and investigate the nature of their interactions with millipedes.

P15 - **Prevalence of antibodies to *Trypanosoma cruzi* in black bears from California**

T'keyah Dennard, Alexa von Dohlen

Johnson C. Smith University, Charlotte, NC

Chagas' disease is a zoonotic disease caused by the insect-vectored protozoan parasite, *Trypanosoma cruzi*. Chagas' disease can cause fatal cardiac infections in both humans and animals. *Trypanosoma cruzi* is endemic in many wildlife species in the United States, but little information is available regarding *T. cruzi* infections in bears. Only 2 cases of *T. cruzi*-infected bears have been reported worldwide. The present study was carried out to determine the prevalence of antibodies to *T. cruzi* in black bears from California. Serum samples from 113 black bears collected in California were tested for antibodies to *T. cruzi* with rapid immunochromatographic dipstick assays. Antibodies to *T. cruzi* were detected in 5 of 113 (4.4%) samples tested. These results suggest that black bears are exposed to *T. cruzi* at a low rate in California.

P16 - Comparison of Infection Prevalence and Intensity by the Trematode *Metagonimoides oregonensis* Between Two Species of Plethodontid Salamander

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Host specificity, the degree to which a parasite relies on a particular host species, is a crucial factor shaping parasite evolution and community dynamics. It is common for parasites to express different levels of host-specificity, which can be influenced by the behavior and ecology of both the parasite and the host. Research has shown a digenetic trematode (Metagonimoides oregonensis) utilizes multiple salamander species as intermediate hosts in its life cycle, but the Southern Black-bellied Salamander (Desmognathus amphileucus) is recognized as the preferred primary host. This has been explained by the large body size and long larval period found in D. amphileucus. Many questions remain unanswered within this host-parasite system, though peculiar host-specific patterns have been documented. We investigated this system further, comparing infection intensities between two sympatric potential salamander hosts, D. amphileucus, and the Red Salamander (Pseudotriton ruber), which are similar in both body size and length of larval period. We collected larval salamanders from a first-order stream in Banks County, Georgia. After collection, we counted metacercariae visible through the ventral body wall between limb insertion points. We compared mean relative infection intensities between the two hosts. Our results show that P. ruber had significantly lower infection rates than D. amphileucus, despite similarities in larval size and length of larval period. This suggests that M. oregonensis is more host-specific than previously suggested. These findings also signify the first report of M. oregonensis utilizing P. ruber as a second intermediate host.

P17 - Soil Moisture Alters Belowground Nematode Interactions

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A changing climate can disrupt biotic interactions between plants, agricultural pests, and parasites with consequences for agricultural management and production. Many of these interactions are mediated by volatile organic compounds (VOCs) which can be used for communication under appropriate environmental conditions. Behavioral responses to these compounds may likewise be environmentally dependent and be affected by a changing climate. To determine how changing environmental conditions may affect VOC mediated biotic interactions, we used a belowground system where entomopathogenic nematodes (EPNs) - tiny roundworms parasitoids of insect larvae - respond to VOCs by moving through the soil pore matrix. Specifically, we used two genera of EPNs - *Heterorhabditis* and *Steinernema* - that are known to respond to three specific terpenes - α-pinene, linalool, and d-limonene - released by the roots of plants in the presence of herbivores. We assessed the response of these nematodes to these terpenes under three moisture regimes to determine whether drier conditions or inundative conditions may influence the response behavior of these nematodes. Our results illustrate that the recovery rate of EPNs is positively correlated with soil moisture concentration. Contrary to prior research, the treatment terpenes did not influence EPN chemotaxis. Interestingly, cardinal directions impacted EPN behavior for *Heterorhabditis*, but not *Steinernema*. On a broad scale, we demonstrate that soil moisture positively influences EPN host-seeking behavior, which in turn may increase efficacy as biological control in agricultural settings. However, EPN efficacy as biological control agents could be reduced as climate change projections predict decreasing soil moisture concentrations.

P18 - Stream Salamander (genus *Desmognathus*) Distributions Along Southern Appalachian Headwater Streams

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Previous work with stream salamanders has indicated that species will assemble by size along a gradient from the stream. The largest species is often directly in the stream, with each smaller species being pushed farther away from the stream. The exact mechanism for this pattern has been hypothesized as competition or predation, with studies providing support for both hypotheses. All the previously published data has come from 2 sites (Coweeta Hydrological Lab and the North Carolina side of the Smoky Mountains). We examined if this pattern of size distribution was consistent across additional stream sites in the southern Appalachians. We hypothesized that the larger individuals, even when an additional larger species was present, would mainly be found in streams and smaller species would be furthest from streams. We sampled 3 stream sites during the day along transects away from streams. We found that the 2 largest species (shovel-nosed and blackbelly salamanders) were almost exclusively found in the streams. The intermediate sized species (seal) was mostly within the splash zones of the streams. The smallest species (mountain dusky and seepage salamanders) were found the furthest from streams. Our additional 3 streams support the general hypothesis that larger species are found mostly in streams and smaller species are more terrestrial. One interesting finding from our work was the co-occurrence of the 2 largest species in the smaller streams. This suggests that competition may not be strong among those 2 species or that streams with both harbor more resources.

P19 - Life Underground: Exploring Behavior of *Curculio sayi* Larva in Soil

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With the introduction of new blight-resistant chestnut trees comes the increase of their primary pest: *C. sayi*, the lesser chestnut weevil. Infected chestnut trees are subject to irreparable damage caused by the consumption of the nuts or the introduction of pathogens by the lesser chestnut weevil. This occurrence is affecting both the commercial agriculture industry and the efforts towards habitat restoration. The life cycle of *C. sayi* is not well understood, and how they respond to specific environmental conditions is similarly unknown. The little research that exists focuses on the behavior of the adults, but even less research can be found in regards to the larval stage. In previous studies, adult weevils have been tested for their attraction to certain volatiles found in their natural habitats, but no research has been done on the larva behavior. This experiment aims to understand and explore the behavior of the larva within the soil. Bioassays were conducted using a two-choice olfactometer where the larva was given an opportunity to choose between different characteristics common to the belowground environment, such as other larva, exposure to different moistures, and soil containing different organisms.

The results indicated that factors influencing belowground larva behavior are more complex than we expected. These results could be used to design effective management strategies for chestnut weevil larvae.

P20 - Effects of elevation on morphological traits in a vulnerable salamander: *Plethodon welleri* (Weller's salamander)

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Southern Appalachia is home to an array of diverse wildlife taxa. One prolific group in this region is lungless salamanders of the Plethodontidae family. Despite the prevalence of these amphibians, fundamental data on many species is missing from current literature, which can lead to voids in information that is crucial to conservation planning. *Plethodon welleri* (Weller's salamander) is an example of a data-deficient species that is endemic to Southern Appalachia and considered vulnerable in its conservation status. Our study set out to determine if certain morphological traits of *P. welleri* vary along an elevational gradient. We hypothesize that body size (snout-vent-length, SVL) will increase with elevation. Additionally, we hypothesize that head size (head length and width) and limb length (humerus/femur length) will also be positively correlated with elevation. To investigate morphological variation at different elevations, we measured and compared *P. welleri* individuals from 11 populations in North Carolina and Tennessee. Individuals were photographed and measured using ImageJ. We found no significant effect of elevation on SVL or head morphology across populations. We did find a significant effect of elevation on leg length with both front and rear limbs being shorter in populations from higher elevations. These findings suggest that *P. welleri* body size may not be influenced by elevational gradients, a trend that has been documented in other Plethodontid salamanders. Our results also suggest that leg length in *P. welleri* may be impacted by elevation, but more research is needed to understand the biological implications of this finding. Overall, our study provides new information on how an important life history trait may interact with this species' environment which could be valuable in developing informed, targeted conservation efforts.

P21 - Shelter Preference of *Cambarus robustus,* a Surrogate for The Federally Threatened *Cambarus callainus*

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Cambarus robustus, the Big Water Crayfish, is a tertiary burrowing crayfish species native to the eastern coast of the U.S and Ontario. *C. robustus* is a commonly occurring, large-bodied crayfish that inhabits lotic environments and prefers large slab boulders for shelter. This species serves as a potential surrogate for related species of conservation concern such as the Big Sandy Crayfish, *Cambarus callainus,* and the Guyandotte River Crayfish, *Cambarus veteranus* as life history strategies are similar. Currently, there is no standard for individual captive husbandry for Cambarid species, despite captive propagation being an important factor in the reintroduction of these species. In order to set a baseline protocol for these federally listed *Cambarus* species, a shelter preference study was conducted using *C. robustus.* 31 individual crayfish took part in two trials each, where shelter choices included a natural rock shelter and a piece of clear acrylic, or a natural shelter and tinted acrylic. Trials were conducted over a period of 24-hours, where shelter usage and behavior were monitored through video recordings. Our results suggest that *C. robustus* will use all shelter types, although natural shelters were occupied more frequently. Sex and size had minimal or no influence on overall shelter use. Future research should continue to investigate optimal husbandry practices and rearing techniques for *Cambarus* species where propagation efforts are necessary.

P22 - Invasion of the Squirrel Treefrogs and Other Grand Speculations

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Recent patterns of a 2.5-year study of hylid frog diversity and movement across a suburban campus in Metro Atlanta using hanging pipe traps indicate a sudden uptick of Squirrel Treefrogs (Hyla squirella) concurrent with a gradual decline in observations of Green Treefrogs (Hyla cinerea). The observed number of Gray Treefrogs (Hyla versicolor) has remained relatively steady. In this poster, we illustrate these patterns as well as speculate wildly about their meaning. Is this an invasion of squirrel treefrogs? Or are they just passing through? Some possible reasons: Metro Atlanta is among the fastest-developing regions in the United States and squirrel treefrogs are more adaptive to disturbed habitats. Squirrel treefrogs might outcompete green treefrogs for food and habitats and might be directly pushing green treefrogs out of the area. The range of squirrel treefrogs may be expanding northward as a result of climate change. The introduced Cuban treefrog is becoming prevalent in Florida, which could explain the decline of the native treefrogs as Cuban tree frogs begin to enter Georgia. Lastly, there is currently an overall decline in amphibian populations in the United States which could attribute to shifts in patterns of distribution and movement. Or maybe this is not a really pattern at all.

P23 - Identifying pollinators of wild ramps using the COI barcode

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Ramps (*Allium tricoccum* Aiton) are a perennial North American species of wild onion. Ramps are highly regarded in both traditional cuisine and Native American medicine and are highly sought after during their short growing season in early spring, to the point of being threatened by overharvesting in many locations. Ramps commonly grow in colonies within deciduous forests in shaded, moist areas. They bloom early in the summer, and in order to produce fruits and seeds, they need to be pollinated by insects. However, little

is currently known about the identity of these pollinators. For this study, we did visual surveys in two ramp populations in Grafton, WV, and Bolivar, PA, during the summer of 2023. A total of 45 insects were observed visiting the ramps. These insects were collected in ethanol, their DNA was extracted, and the universal barcode for animals, the mitochondrial cytochrome oxidase subunit I (COI) gene was amplified. Resulting DNA sequences were then compared to the NCBI and BOLD databases to identify the insects. Our results show that honeybees, bumblebees, syrphid flies and other insects visited ramp flowers. Due to the varied morphology of the collected insects, our study shows how DNA barcoding may be a more straightforward and time-effective method for identifying potential pollinators that does not require taxonomical expertise. Our research contributes valuable knowledge on the pollinators of a meaningful plant in West Virginia culture and history.

P24 - What, if anything, is the amphibian microbiome?

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Host-associated bacterial communities exist on a dynamic spectrum ranging from intimate associations to casual assemblages. Large, complex communities such as gut and skin microbiomes are reliant on the interplay between environmental reservoirs, ecological interactions, and host traits. Diverse communities with diffuse interactions thus pose challenges for understanding the ecological and evolutionary dynamics of host-associated communities. In this study, we use the amphibian skin microbiome as a model to understand the assembly of external host-associated communities in the context of environmental reservoirs. First, we assessed similarities and differences according to habitat, microhabitat, and host species. We then assessed these patterns of dissimilarity using null ecological models in the context of host-filtering, priority effects, environmental transmission, and random differences. Lastly, we sampled *Eurycea* cf. *wilderae* seasonally for one year within aquatic or terrestrial habitats to assess temporal turnover regarding habitat changes and fidelity of taxa over time and space. Our results indicate salamander-associated communities are highly variable between individual salamanders, suggesting widespread differentiation stemming from idiosyncratic, as opposed to salamander-specific, conditions. This turnover is exacerbated when hosts undergo habitat shifts, and fidelity of taxa is limited to a subset of taxa. Apart from this subset, the salamander skin microbiome is a product of weak and random ecological processes, with differentiation from cover objects stemming primarily from stochastic dispersal or random local extinction at the lowest taxonomic levels.

P25 - From lawn to oasis: sub-urban pollinator conservation through native landscape design

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Pollinators are declining globally, especially due to habitat loss and fragmentation. This is of great concern in Florida since it is one of the fastest-growing states in the U.S. Urban habitats have the potential to provide essential foraging and nesting resources for native pollinators with diverse plant landscaping. This research, which took place in the greater Orlando, FL area, examines the effects of landscape design on pollinator visitation and species richness in two distinct suburban neighborhoods; one with traditional landscapes with mostly turf and non-native plants and another with novel landscapes planted entirely with native plants and no turf. Four focal plant species known for their attractiveness to native pollinators were introduced to five backyards in both neighborhoods. Pollinator visitation at each site was recorded during 15-minute observation periods for three consecutive days. We found significantly more pollinator visits and species richness in the novel landscapes and also found differences in visitation and visitor richness between the various focal plant species. The results from this pilot study highlight the potential for small, supplemental plantings to quickly enhance pollinator communities in traditional landscapes.

P26 - Comparison of carbon storage in second-growth forests of Panama and the Piedmont of North Carolina

Megan Green, David Vandermast

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In recent years, carbon storage in forests has become a topic of increasing interest as the Earth's climate undergoes changes due to anthropogenic climate change. The need to limit CO2 emissions has focused the attention of policymakers and ecologists on the role that forests play in the global carbon cycle. Forested ecosystems store significant amounts of carbon, particularly in tropical areas. Panama is historically under-valued in the global carbon budget, with most estimates of carbon storage coming from remote sensing and field data from studies conducted in adjacent countries. In this study, we compared carbon storage in two Panamanian tropical forest ecosystems, a montane cloud forest in Parque Internacional la Amistad (PILA) and a lowland tropical forest on Barro Colorado Island (BCI), to three North Carolina Piedmont forest ecosystems, Elon University Forest (EUF), Cedarock Park (CP), and Cane Creek Mountains Natural Area (CCMNA). We used field data, published algorithms, and specific gravity equivalents to estimate carbon storage (CO2e, or carbon dioxide equivalent) as 45-50% of biomass in each forest. In Panama, carbon stored in PILA totaled between 140.0 – 155.6 Mg/ha, and in BCI carbon storage totaled 281.6-312.9 Mg/ha. In North Carolina, CP stores between 160-181.1 Mg/ha, CCMNA between 190.7-211.3 Mg/ha, and EUF between 88.9-99.9 Mg/ha. Carbon storage in second-growth Panamanian forests equaled or exceeded that of second-growth North Carolina forests (EUF and CP) and was equal to carbon storage on CCMNA, an old-growth forest. Our estimates for Panama are based on tree identification at the taxonomic family level, a method that is not traditionally utilized for carbon storage estimates, but that provides greater detail than does remote sensing. Our results indicate that Panamanian forests are significant carbon sinks and that more field research would increase the accuracy of the carbon budget of Panamanian forests.

P27 - Seasonal Variation in Infection Intensity of *Desmognathus amphileucus* larvae by the trematode *Metagonimoides oregonensis*

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The trematode *Metagonimoides oregonensis* is a common parasite in Appalachian streams. These parasites have a complex life cycle, which features the salamander *Desmognathus amphileucus* as a second intermediate host. Because increased levels of infection intensity can lead to enhanced negative effects on the host, understanding possible seasonal variation in infection can be informative of variation in potential virulence. To understand the factors behind varying intensity levels, we determined whether intensity of infection by *M. oregonensis* varies seasonally in larvae of the host *D. amphileucus*. We collected salamander larvae from two different tributaries of Nancytown Creek in Habersham, Georgia, which vary in both snail density and intensity of metacercarial infection. To measure seasonal variation, we took four different samples over the course of 2023 that were representative of each season: February, May, August, and November. We immobilized salamanders with a wet sponge in a plastic petri dish and counted all of the metacercarial cysts visible through the ventral body wall between the insertions of the limbs under a dissecting microscope. Using a two-way ANOVA, we determined a significant difference in relative intensity among seasons with the highest intensity of infection in November. There was a marginally non-significant difference between streams. Because both host and parasite in this system are ectothermic, we concluded that increased infection during November was likely the result of a delayed response to warm-season activity.

P28 - Estimating the Carbon Sequestration of Cane Creek Mountains Natural Area Using GIS

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Cane Creek Mountains Natural Area (CCMNA) is a relatively new park in Alamance County, North Carolina opening officially in 2020. Much of the park is an ancient monadnock, upon which there is no obvious evidence of intensive land use (no plow lines, etc...) and the forest composition and structure appears to be consistent with that of an old-growth forest. The purpose of this study was to document the composition and structure of the forested parts of the park and to estimate the amount of woody biomass and carbon stored within it. Local parks like CCMNA are valuable in the mathematics surrounding anthropogenic climate change and old-growth forests in particular can store a lot of carbon. We collected data from 83 non-permanent plots during the fall of 2022, using prism cruising to identify trees for which we measured diameter (DBH). Our results indicate that the forest is dominated by Chestnut oak (Quercus montana) and White oak (Q. alba), which are 514 of the 930 (55.3%) trees we sampled. The Shannon diversity value was 2.13 and evenness and dominance were .23 and .61 , respectively. We calculated aboveground woody biomass using published algorithms that use DBH and species data. From the biomass data, we calculated a range for carbon storage in the trees at CCMNA of 190.8-211 Mg/ha Co_2e (megagrams per hectare of CO_2 equivalent) based on carbon being between 45-50% of the biomass in woody tissue. This range is in line with calculations of biomass on other Alamance County sites: Cedarock Park (163-181.1 Mg/ha CO_2e) and Elon University Forest (88.6-98.5 Mg/ha CO_2e). Our findings indicate the presence of a mature oak-dominated forest in Alamance County that is an important ecological resource for the area, offers unique recreational experiences, and stores a significant amount of carbon.

P29 - Monitoring Restoration Efforts for Eastern Hellbender (*Cryptobranchus alleganiensis*) Habitats

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Eastern Hellbenders (*Cryptobranchus alleganiensis)* have been severely threatened in the last several decades, in part due to habitat disturbance and declines in water quality resulting from sedimentation and the introduction of foreign pollutants. Ongoing efforts to monitor and restore hellbender habitats are often hindered by a lack of within-drainage reference data that can be used to guide habitat restoration efforts. We used a before-after control-impact (BACI) design to assess the efficacy of hellbender habitat restoration in a severely degraded portion of the Middle Fork Holston River in southwestern Virginia, USA. This reach has recently undergone restoration efforts, including the placement of cover rocks as artificial refugia. We used data reflecting attributes of cover objects from this reach, along with water quality, particle size distributions, and fine sediment intrusion data, to compare the restored reach with nearby undisturbed reference reaches before and after the start of restoration efforts. Our BACI design detected a significant change in the degraded reach from a pre- to post-restoration condition, with restoration efforts placing degraded habitat on a similar trajectory to reference reaches with confirmed hellbender presence. Our method of observation allowed for a clear cause-and-effect relationship to be recorded and trends to be confirmed that potentially boost habitat availability for Eastern Hellbenders, using data from native habitat conditions at reference reaches within the same waterway. Our approach can be coupled with long-term surveys to assess changes in Eastern Hellbender activity as a result of restoration efforts and to determine how structural habitat restoration efforts benefit hellbender populations.

P30 - Co2 Emissions of Differing Farming Practices

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In 2020, the agriculture sector was responsible for 11.2% of U.S. greenhouse gas emissions. This is a significant proportion of total emissions and reducing it gets the U.S. closer to the UN Paris Accord agreement of net zero emissions. Additionally, many people prefer to purchase locally produced vegetables and providing them with useful information regarding carbon cost is helpful for their

decision-making process. This study aims to examine the carbon cost of producing lettuce from seed to harvest in two agricultural methods: large-scale farming and local small-scale farming. To collect data, we contacted small-scale farms and provided them with an on-line questionnaire and we used published data to estimate the carbon costs of vegetable production on large-scale farms. We found a wide range of carbon production by farming method: large-scale farming practices average 0.57 lbs. of CO2 per lb. of produce while organic farms average from 0.0096 to 0.181 lbs of CO2 emissions per lb. of produce. We focused our study on the production of lettuce because it has a low CO2 cost, so while the numbers for both large and small-scale farms appear small, our results indicate that small-scale farms have between 68.2% and 98.3% less carbon emissions per lb. of lettuce than do large-scale farms. The diversity in these results illustrates the variability of the agricultural sector. Notably, our results suggest that small-scale farming methods appear to be closer to carbon-neutral and are more sustainable relative to carbon production, emphasizing the importance of supporting local agriculture.

P31 - Sexual dimorphism of head size in *Notophthalmus viridescens viridescens*

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Many species of animals display some level of sexual dimorphism, which can be seen in a wide array of different physical features across different taxa. In salamanders, a common sexually dimorphic trait is head size. This trait is especially prevalent and well studied in various *Plethodontid* salamanders, with male heads typically being larger in most species. Sexual dimorphism in head size, however, is less understood in *Salamandrid* salamanders, especially the Eastern Newt, *Notophthalmus viridescens*. Based on one study in Pennsylvania, we expected that male newts would have larger heads than female newts. To test this hypothesis, we examined head size in Eastern Newts in the northeastern region of North Carolina, using individuals from Watauga and Ashe Counties. We recorded the sex, Snout-vent Length (SVL), head length, and head width of 115 individuals (38 females and 72 males). We sampled sites across varying elevations to reduce bias into our dataset. We found that the average SVL of both sexes were not statistically different from one another. We also found that females had both statistically greater average head width (8.32 mm) and head length (11.46 mm) compared to males (7.93 mm and 10.19 mm, respectively). This result differs from the only other study examining newt head width in Pennsylvania. Our results suggest that generality in sexual dimorphism may not exist across newt populations. Further investigation into other factors influencing morphological plasticity of adult newts will shed light on these differences.

P32 - Correlations between Climate and Growth in Pine Species from the Blackwater Ecological Preserve, Isle of Wight Virginia

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Dendrochronology can determine the correlations between climate and growth in annually-formed tree rings. In our study, chronologies were created for *Pinus palustris* (longleaf pine), *Pinus taeda* (loblolly pine), and *Pinus serotina* (pond pine) from living trees located in the Blackwater Ecological Preserve in Isle of Wight county, southeastern Virginia. From these chronologies, correlations between growth and climate variables (precipitation, Palmer drought severity index (PDSI), minimum temperature, maximum temperature) were determined. Moving plots of the data were generated to visualize how relationships between climate and growth change over time. For PDSI, longleaf pine trends are increasingly positive for August and September 1970 to 2020, while for loblolly, July through October is trending down to neutral for 1981 to 2020. During the period of May through July, pond pine trends decline toward neutral for 1978 to 2020. Precipitation during the summer months of the current year is trending more positively for all three species from 1976 to 2020. For minimum temperature, loblolly and pond pine are trending more positive for February and March 1980 through 2020, while longleaf pine displayed the same trend for March and April 1977 to 2020. Pond pine displays an increasingly negative trend for previous October 1981 through present. All three species show an increasing positive trend in maximum temperature for February 1980 to 2020 and increasing negative trends for summer months 1973 through present. Overall, growth for all three species is correlating more positively with precipitation during the late growing season, positively with minimum temperature during late winter, and increasingly negative to maximum temperature during the summer season.

P33 - Effects of temporal variation in habitat moisture on the success of anuran behavioral strategies

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Amphibians make behavioral decisions based on both internal and external conditions and are particularly sensitive to moisture levels. Climate change is predicted to cause weather in the Unites States to extremify over time, including less frequent, heavier precipitation and higher extreme temperatures. The success of amphibian behavioral strategies may therefore change as the availability and predictability of resources change. Latency time is the time taken for an individual to emerge from a shelter after disturbance and is often linked to boldness. In this study, we tested the effect of desiccation, substrate type, and species on latency time in three frog species (Acris crepitans, Lithobates clamitans, and Lithobates sphenocephalus) and used the results to parameterize an individual-based model investigating the effect of temporal autocorrelation in the environment on the success of risk-taking strategies. We measured the effect of substrate, species, and desiccation level on the latency time of 65 individuals and found that species and substrate impacted latency time, but we did not detect an effect of desiccation. We used these data to parameterize a spatially-explicit individual-based model. The landscape was composed of patches with varying moisture values. The patches' moistures were generated stochastically from a Gaussian distribution, then modified to exhibit spatial clumping and temporal variability. Agents within the landscape made movement decisions based on internal and external moisture values. The values at which movement was triggered were related to behavioral type. We varied boldness (propensity to leave a habitat patch based on a moisture threshold) and temporal variation in

moisture in a full factorial design, with 17 boldness levels and 10 levels of temporal variability. We found that bolder strategies became less successful with lower temporal autocorrelation. Considering the increasingly variable climate, predicting the persistence of amphibian populations necessitates an understanding of the consequences of behavioral strategies.

P34 - It's a sticky situation: abundance and identity of arthropods trapped on tarflower (*Bejaria racemosa*) inflorescences

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Sticky surfaces of plants may function as a defense against herbivores by trapping arthropods. Tarflower (*Bejaria racemosa*), a shrub endemic to the southeastern United States, produces a sticky substance that is present on petals emerging from flower buds, the bottom of flower petals, and fruits. Our research aimed to assess the effects of habitat, reproductive shoot height, the number of inflorescences, and time since fire on the number of arthropods trapped by tarflower in Florida scrub habitats. We also investigated the identity of trapped arthropods and whether arthropod identity differs with flower stage (closed or open) or time since fire. We haphazardly selected 20 tarflower individuals (10 in flatwoods and 10 in scrubby flatwoods habitats) in sites ranging from 2 to 15 years post-fire. We measured the height of the tallest reproductive shoot and counted the number of inflorescences for each individual. We collected inflorescences and identified entrapped arthropods to order or family. The number of trapped arthropods did not differ between tarflowers in flatwoods and scrubby flatwoods. Across both habitats, the number of arthropods trapped was not related to the height of the tallest reproductive shoot, the number of inflorescences, or time since fire. Of the 410 trapped arthropods we identified, 51% were in the order Hymenoptera, 26% were in the order Thysanoptera, and 15% were in the order Diptera. Overall, there was a similar number of arthropods trapped on closed and open flowers, but hymenopterans and thysanopterans tended to be more associated with closed flowers. The proportion of trapped arthropods that were dipterans, hymenopterans, or thysanopterans did not vary with time since fire. We found that the arthropods most commonly trapped by tarflower are not herbivores, which suggests that stickiness in tarflower may function as an indirect defense rather than a direct defense against herbivores.

P35 - Influence of Incubation Techniques and Parentage on Boldness in *Hydrodynastes gigas*

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The subject of snake boldness, exploration, and personality have only recently been recognized in herpetoculture. The question as to whether these ectotherms can possess higher intellectual thought is still debated. It is, however, known that reptile and avian eggs are capable of communicating embryo to embryo, but the lasting effects of this pre-hatch communication on post-hatch personality is understudied. The study's goal is to determine if incubation or parentage influence boldness in hatchling False Water Cobras (Hydrodynastes gigas). There were three unrelated breeding pairs, that produced 122 hatchlings, n = 122. Each clutch was divided as evenly as possible into two treatments once laid. One treatment was incubated as a group, with the eggs making direct contact throughout the incubation period. The other treatment incubated the eggs individually, without any egg-to-egg contact throughout the incubation period. Each hatchling was reared individually with identical methods and underwent three trials apiece with a one-week period between each trial. Each trial consisted of a five-minute habituation period followed by a fifteen-minute maximum trial period. Temperatures were recorded inside the arena (Grow Tent) and in the hide box, before and after each trial to ensure consistency. The trial was considered over once the individual had either fully exited the hide box or the fifteen-minute period had expired. Throughout the trial the time of the head, middle third of the body, and tail emergence from the hide box were recorded. Additionally, behavioral observations were recorded each minute of the trial. Methods will be replicated in the adult individuals as well, which will provide the data necessary for parentage analysis.

P36 - Shrub species differ in their ability to create fertility islands in Florida rosemary scrub

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Shrubs can create patches of high resource availability, called fertility islands, by funneling organic matter and moisture under their canopies. We tested the hypothesis that shrub species differ in their ability to create fertility islands in Florida rosemary scrub. We focused on the species *Ceratiola ericoides* (Florida rosemary), *Sabal etonia* (scrub palmetto), and *Lyonia fruticosa* (staggerbush) in a site 28 years post-fire. We measured shrub size and assessed litter cover and depth, soil moisture and organic matter, soil nutrient availability, and presence of understory species under shrubs and in open areas among shrubs. *Ceratiola* and *Lyonia* had a larger canopy area and volume than *Sabal*. Litter cover was higher under *Ceratiola* and *Lyonia*, while litter depth was higher under all shrubs than in the open. Soil organic matter and soil moisture did not differ among locations. Nitrogen availability was lower under *Ceratiola* and *Lyonia*, while calcium and magnesium were higher under *Ceratiola* and *Lyonia* than in open areas among shrubs. Phosphorus availability was higher under only *Ceratiola*, while potassium was higher under all shrub species than in the open. Higher amounts of litter under shrubs did not lead to higher soil organic matter. Nonetheless, availability of all nutrients except nitrogen was higher under at least one shrub species than in the open. Although availability of most nutrients was higher under *Ceratiola* than in the open, there were few understory species under *Ceratiola*, likely due to its allelopathic effects. In contrast, although *Sabal* did not generally have higher nutrients under its canopy, we found more understory species under *Sabal*, likely due to the shade provided by live and dead leaves. Differences in the ability of shrub species to create islands of fertility appears to contribute to spatial variation in resource availability and understory species in Florida rosemary scrub.

P37 - Increasing the Accuracy of Tree-Ring Data Processing to Improve Models for Predicting Future Climate

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Tree-ring data is used to reconstruct past climate and to predict future climate trends. In each year of a tree's lifespan a distinct ring is added to the tree's width, and the widths of individual rings vary depending on the environment in which a tree lives. To process tree-ring data, two cores from each tree are typically extracted, and then all cores are combined before analysis. Our preliminary investigation of data from the International Tree-Ring Data Bank found that correlated tree cores (cores from the same tree) do not necessarily have the same ring widths, and trees with low correlation may have worse correlation with local climate data. These findings imply that only trees with moderate or better internal correlation should be used for climate modeling. We aim to improve the modeling of future climate scenarios by assessing the accuracy of tree-ring data collection. To assess the accuracy of different combination methods, we collected 47 tree cores from Virginia pines (*Pinus virginiana*) in Elon University Forest (EUF). We chose Virginia pine for this study because of the abundance of this tree at EUF and because the rings grow with clear distinctions between earlywood and latewood, making annual growth easy to measure. The widths of the rings on each core will be combined and correlated with local climate data using standard statistical techniques. By combining these cores according to existing dendrochronological methods, we can recommend the best method as the one that produces the best-fit with local climate data.

P38 - Using stable isotopes to examine dietary niche space of three coexisting Plethodon salamanders in North Carolina

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The southern Appalachians harbor a high diversity of various taxa, particularly lungless salamanders of the family Plethodontidae. Upwards of 6 closely related Plethodontid species can coexist in certain terrestrial and aquatic communities. Despite the coexistence of multiple species, 1-2 species tend to be numerically more abundant. Interspecific competition may explain this dominance, and prior research with terrestrial salamanders suggests that competition may limit the distribution and abundance of Plethodon salamanders. However, environmental parameters likely effect the extent of any competitive interactions. Three species of large-bodied Plethodon salamanders (*Plethodon montanus, P. cylindraceous, P. yonahlossee*) can be found coexisting in forested ecosystems of northwestern North Carolina. Little is known about the factors that permit this coexistence, but diet may be one contributing factor. Therefore, we sought to understand overlap in dietary niche space of these 3 species in 4 separate communities. Given the limited data on diets, we predicted a generalist diet for each species with significant overlap in dietary niche space. Previous work has shown that tail tips can provide coarse information on salamander diets without the need to sacrifice individuals. Therefore, we calculated isotopic niche space and diets of each species using tail tips from field collected individuals in summers of 2021-2022. We found significant overlap in niche space among the 3 species across all 4 communities. We also found that one species, *P. yonahlossee*, appears to be consuming different forest floor invertebrate guilds in comparison to the other 2 species. These findings suggest that the 3 focal species may be eating prey with similar Nitrogen values, but 1 species may be partitioning prey to reduce competitive interactions. This dietary niche partitioning may provide some explanation for current patterns of coexistence at our sites.

P39 - Analysis of the accuracy of student-collected CURE data in an outdoor setting

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Classroom Undergraduate Research Experiences (CUREs) have become an increasingly popular way of introducing science to college students. In 2021 and 2022, a non-majors biology class at Elon University used a carbon storage protocol in Elon University Forest (EUF) to introduce students to the scientific method and to have them collect data for use in an ongoing project. The protocol uses tagged and numbered trees (stems > 3cm DBH) in 100 m2 modules to measure DBH to assess annual changes in carbon storage. The purpose of this study was to determine the accuracy of the data collected by these students. We found that students failed to measure between 20.3-33.6% of tagged trees during the two years of data we analyzed. We compared the standard deviation (stdev) of student data from both years, and principal investigator (PI) measurements from 2023, to PI data collected in 2020. We found 1) considerable variation in stdev between years, 2) that the stdev of student measurements from both years significantly ($\alpha > 0.05$) exceeded those of the PI from 2023 (stdev range of 0.14-21.7cm in 2021, and 1.34-40.2cm in 2022 vs. 0.0-0.5 for the 2023 PI measurements), and 3), that the stdev of student data increased with increasing tree size. We conclude that the student-collected measurements in this study are not reliable enough to for publishable data. We recommend greater quality control on the part of any instructor who would like to use field data collection as part of a CURE, if scientific use is the goal.

P40 - Environmental Drivers of Seedling Distribution in a Northwoods Forest Landscape

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Mature tree survival and capacity to live with less open canopies can differ from that of seedlings and there could be substantial differences between adult and seedling distributions even in relatively stable forest structures. Northern hardwood forests have low overall diversity but widely distributed species and wetland habitats, and they provide a useful model for examining aspects of forest

ecology in this region. Low elevation sites are wetter and often closer to peat bogs or vernal ponds. We surveyed regularly placed plots across the landscape to determine which environmental gradients best predicted tree seedling distributions. We tagged and identified all seedlings within a height range between 20 and 100 cm within each of 90 1x1 m plots. The plots were spaced every 20 m in a grid and a canopy openness measure was obtained for each. We matched NEON AOP slope and elevation data with a 1 m resolution for each of the plots in the study area. There were only 15 tree species observed amongst all plots, with sugar maples (Acer saccharum) being the most common. Significant increases in the abundance of red maples (A. rubrum) were associated with lower elevations and were expected because this species is known to prefer wetter areas. Across the plots there was a large amount of variability in species diversity, but principal component analyses showed that distribution varied substantially with both elevation and canopy openness across the landscape. More open canopies had lower diversity, but may allow species to obtain a higher relative abundance due to greater photosynthetic carbon gain and subsequent growth. Elevation may control the presence of species depending on their tolerance and need for abundant soil water.

P42 - Unraveling the impact of salinity and burial on *Morella cerifera* growth in a changing barrier island landscape

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In coastal environments, shrubs have encroached into grasslands due to warmer winter temperatures; however, it is unknown how stressors related with storm disturbance influences shrub survival and growth. The encroaching evergreen, native shrub, *Morella cerifera* (hereafter *Morella*) is protected from salt and sand stress by high dunes. When dunes are destroyed by storm overwash, the habitat can receive higher salt and burial disturbance. The goal of this study was to examine the independent influences of salinity, burial, and the combination of both on the growth of *Morella*. The experiment took place in a light and temperature controlled environment. A single pot contained one *Morella* seedling with grasses to simulate the natural microhabitat. Treatments consisted of no burial or salinity (control), salinity only, burial only, and salinity x burial (n = 7). To mimic a massive storm disturbance, seedlings were treated with 35 ppm salinity one time and/or burial to 75% of plant height. Shrub growth (i.e., height and canopy growth) was monitored for 3 months. Burial had no effect on *Morella* seedlings height or canopy growth rates, but salinity and salinity x burial induced significant reductions in both height and canopy area growth rates ($p < 0.01$ for both). These results show that a one time salinity disturbance of full strength seawater limits the growth of *Morella* seedlings, but sand burial has no effect. With projected increases in storms and sea-level rise, salinity exposure will be an important control on shrub encroachment.

P43 - Secondary successional changes in Elon University Forest following the 2014 ice storm

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How forests respond to disturbances is a fundamentally important question in forest ecology. This study investigates secondary ecological succession in Elon University Forest (EUF), following a significant ice storm in March 2014. More specifically, this study aims to compare forest metrics such as tree species richness, basal area, and diversity from 2010 (before the ice storm), 2014 (the summer after the ice storm), 2018, and 2023. In 2010 researchers from Elon University established eight 20 x 50 m Carolina Vegetation Survey plots within parts of the forest of different ages, ranging from approximately 40 years old to what is known as the Forest Of Continuity (FOC), which includes trees upwards of 250 years old. Within each plot, all trees (stems $\geq$ 10 cm DBH) were tagged, identified, and recorded. We hypothesize that, because the ice storm primarily killed early successional Virginia pine (*Pinus virginiana*), it acted as a catalyst for an increased rate of secondary succession. Our data supports our hypothesis: mortality of Virginia pine after the storm continues to exceed mortality prior to the storm. Forest metrics indicate that much of EUF is in a transitional phase as dying pines are replaced by hardwoods. For example, the average number of trees per plot, and basal area have remained constant since 2014 but tree species richness (26 to 28) and Shannon diversity (2.39 to 2.74) have increased. These changes are consistent with the mortality of early successional species such as Virginia pine that are being replaced by later successional hardwoods. Data from our study indicates that significant storm events, like the 2014 ice storm can cause a hastening of expected secondary successional changes that continue for many years afterward.

P44 - The use of a modified small stem assay for the evaluation of blight resistance in chestnut seedlings

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In previous work, we evaluated an alternative small stem assay (AltSSA) for blight resistance in backcross hybrid chestnuts (Castanea dentata (Marsh.) Borkh. X C. mollissima Blume). Whereas C. dentata is blight susceptible, C. mollissima has resistance; hybrids thereof are expected to vary in relation to the percent of the genome derived from the parental species (polygenetic inheritance). The method involves inoculating stems of 5 month old potted seedlings that have been snipped off at locations 4 to 5 mm in diameter. Cut stems are inoculated with agar disks containing Cryphonectria parasitica (Murrill) M.E.Barr and are covered for 1 week with plastic sleeves. After about 90 days, cankers are measured and removed by snipping stems below the cankers. AltSSAs were designed to facilitate implemention, to consistently induce cankering, and to encourage seedling recovery by allowing time for new shoot development prior to planting. Previous results showed that AltSSAs can distinguish the full range of expected resistance. Furthermore, one metric (orange-zone canker length; OZCL) correlated best with expectations for seedling families based on estimates of the percent of the genome derived from susceptible (C. dentata) and from blight resistance indices of the parents of each family. In this follow-up analysis of 17 seedling families studied in 2023 (including C. dentata and C. mollissima controls), we show that OZCL again gave results consistent with predictions derived from percent American chestnut ancestry of the parents of each line. Furthermore, mean OZCL of backcross

families ranged from intermediate (F1 hybrid-level) to low (wildtype American chestnut-level), as predicted. Altogether, these results provide further validation that the AltSSA is a viable method for early detection of relative blight resistance in seedlings. This method is thus useful for both backward selection (progeny testing of parents) and for forward selection (selecting candidates for out-planting and further testing and breeding).

P45 - A multi-scale approach to resolving the Guinea worm-fish mystery

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Guinea worm disease (GWD) is a neglected tropical disease that causes significant morbidity and devastating economic outcomes. Historically, transmission was thought to occur when a mammalian host drinks water infested by GW-infected zooplanktonic intermediate hosts (copepods). Despite early eradication successes that focused on filtering drinking water, human cases remain and cases in other mammals are increasingly detected, which likely contributes to GW persistence. GW persistence in the face of strong eradication efforts has been hypothesized to be driven by an alternate route of transmission: fish consume infected copepods and may then be consumed raw or undercooked, by mammalian hosts. However, it remains unclear if this route is new or simply newly recognized, and fish are not yet targeted by control measures. Experiments have shown it is physiologically possible for fish to harbor GW parasites after ingesting infected copepods, but the significance of fish in an alternate transmission pathway is unclear under ecologically relevant conditions. I hypothesize that the ecological context drives the effects of fish on GW transmission: constant co-occurrence of fish and copepods reduces transmission potential, but spatially or temporally variable co-occurrence of fish and copepods could cause brief peaks in transmission. These contrasting predictions arise from our preliminary ODE model results on the balance of predatory effects – constantly high predation suppresses copepod densities and reduces the probability that exposed copepods survive long enough for GW larvae to become infectious, while episodic predation, e.g., as waterbodies merge during the wet season, could enable fish to rapidly consume copepods with mature GW infections. To test this hypothesis, I am using three approaches: experimental, theoretical, and field surveys. This project will help elucidate the importance of fish in GW transmission in endemic settings to expand fundamental understanding of the eradication of parasites with complex life cycles.

P46 - Conservation Starts In Our Own Backyard

Bronwyn Williams

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In 2017, we started Project #F16AF01305 funded by a State Wildlife Grant through the Pennsylvania Fish & Boat Commission. The goal of the grant was to determine the conservation − and taxonomic − status of a population of crayfish in PA belonging to the widespread species complex *Cambarus* species C. While it may seem like a reasonably simple endeavor, the project ballooned out of necessity, dovetailing with ongoing collaborative research with the NCWRC and SCDNR. We used, and continue to use, a taxonomy-agnostic integrative approach, merging genetics, morphology, biogeography, color pattern, behavior, habitat association, etc., within a dense sampling scheme, to characterize the diversity within the region. We use reciprocal illumination to identify areas that need additional sampling. This methodology allows us to evaluate the conservation needs of each taxon in context, prioritize taxonomic action, and immediately advocate for listing where necessary. Our work has highlighted the importance of highly collaborative, regional, integrative work, and the plethora of new-to-science species and conservation questions that exist, sometimes literally in our own backyard.

P47 - Tree mortality and replacement during secondary succession in a North Carolina Piedmont forest

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In the Piedmont of North Carolina it has long been assumed that the dominant climax forest type is oak-hickory, particularly on dry sites. However, in recent years there has been concern that mesophytic maples and beeches are replacing oaks and hickories during secondary succession. In this study, we quantify tree replacement during secondary succession in Elon University Forest (EUF), a natural area consisting of forests of varying ages. We identified 20 fallen trees (10 hardwoods and 10 pines) and recorded the identities and sizes (DBH) of the trees replacing them in a $100m^2$ relevé around the center of each fallen tree. In addition to the identity of each fallen tree, we recorded its diameter (converted to basal area (BA)), and the direction of fall in degrees (transformed to folded aspect to maximize southwest and minimize northeast values). For all trees and for hardwoods and pines separately we examined whether tree size (BA) or direction of fall influenced the number (N), species richness (S), or the Shannon diversity index (H') of the replacement trees. There were no significant relationships between the measures of our fallen trees and those of the replacement trees. We noted that the trees replacing fallen hardwoods were various oaks and hickories, while those replacing fallen pines were most often yellow-poplar (*Liriodendron tulipifera*) and sweetgum (*Liquidambar styraciflua*). In EUF, secondary succession does not appear to result in the replacement of oaks and hickories by mesophytic species.

P48 - Monitoring the Endangered Cape Fear Shiner (Notropis Mekistocholas) presence in the Cape Fear River Basin using environmental DNA

Jack Quintana, Megan Rudock Bowman

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Notropis Mekistocholas, known as the Cape Fear Shiner (CFS), is an endangered species of minnow fish native to the Cape Fear River Basin. This fish species has been monitored by catch and release, a process that is very time-consuming and not 100% accurate. Instead, environmental DNA can be utilized to identify where CFS are located. Environmental DNA is any genetic information left behind by an organism in its environment. First, species-specific primers were designed using NCBI BLAST to amplify a fragment of the 4F4 microsatellite in the CFS genome, while not amplifying DNA in any other species present. Water samples containing shed DNA of organisms recently in the area were collected and filtered on site. The filter paper is preserved until DNA can be extracted in the lab. DNA was amplified by polymerase chain reaction and PCR products are analyzed using gel electrophoresis. Samples were examined for the presence of DNA using 16S and GAPDH primers, as well as the specified 222bp fragment, indicating the presence of CFS. Preliminary data suggest that our CFS specific primers are successfully amplifying DNA in many of our samples. Sequencing has confirmed the presence of CFS in selected samples, however further analysis is necessary to provide a definitive positive match for CFS and lend confidence to this method of monitoring the endangered Cape Fear Shiner.

P49 - A genetic diversity assessment of *Allium tricoccum* populations in Great Smoky Mountains National Park using Next Generation SNP discovery

Lauren Gray, Matt C. Estep

Appalachian State University, Boone, NC

A genetic diversity assessment of Allium tricoccum populations in Great Smoky Mountains National Park using Next Generation SNP discovery Our world today faces an unprecedented loss of biodiversity, and understanding the extent to which species lose genetic diversity is imperative for conservation efforts. Reduced genetic diversity causes species to be less resilient to stochastic change and more susceptible to extirpation and possibly extinction. This is especially problematic for species that have small population sizes or have modes of reproduction that do not facilitate gene flow. Allium tricoccum is a highly sought-after edible plant and is culturally significant to Native Americans, specifically the Eastern Band of Cherokee. Allium tricoccum has been widely used in traditional medicine to cure colds and earache. Due to its delicate, mild onion flavor and aroma, along with its high vitamin content, foraging for this plant has become increasingly popular. Botanists have become concerned that some populations may be eradicated due to irresponsible harvesting. This study will use SNP genetic markers obtained via Next-Generation sequencing technique, MIG-seq to assess the genetic diversity of A. tricoccum populations throughout Great Smoky Mountains National Park. The results from this study can serve as a proxy for population health within Great Smoky Mountains National Park and can help guide management decisions. This study will generate data needed to conserve populations and will play a role in the long-term monitoring of A. tricoccum by providing a base assessment for future research and the potential implementation of future management strategies. It will highlight genetic methods for obtaining population-level information that can be used in future studies analyzing seemingly abundant clonal populations, as well as provide data that can legitimize the Eastern Band of Cherokee's sustainable harvest of this significant plant.

P50 - American Kestrels in Agricultural Landscapes of the Lower Mississippi Alluvial Valley: Nest Box Occupancy, Reproductive Success, and Pest Control Services

Ty Sharrow

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The ecosystem services (i.e., direct predation, perceived risk of predation) provided by native raptors are a potentially sustainable method of pest management. The American Kestrel (Falco sparverius) is a declining generalist predator that can be found in agricultural landscapes where they may consume potential invertebrate and vertebrate pests. However, removal of almost all woody vegetation in agricultural regions such as in the Lower Mississippi Alluvial Valley (LMAV) has eliminated most suitable nesting sites for kestrels, and has likely resulted in low breeding densities of kestrels in this, and other, agricultural regions. Fortunately, kestrels can be attracted to otherwise suitable habitats by adding artificial nest boxes. In this study, we installed nest boxes adjacent to row crops (rice, cotton, corn, and soy) in the LMAV of northeastern Arkansas, USA, in an attempt to attract kestrels to assess their nest box occupancy, reproductive output, and impacts on potential pest populations. We conducted small mammal, avian, and insect surveys to estimate potential pest abundances at both occupied and unoccupied nest boxes, and at random points, during the breeding/growing seasons in 2022–2024 (May–July). This project will provide information on kestrel nest site selection and breeding success in northeast Arkansas as well as data on the effectiveness of kestrels as pest control agents in a row-crop dominated landscape.

P51 - Development of Microsatellite Markers for the Yellow Lady Slipper Orchid (*Cypripedium Parviflorum*).

Elyssa Ghazali, Matt C. Estep

Appalachian State University, Boone, NC

Cypripedium Parviflorum (Orchidaceae, Salisbury) is a perennial orchid commonly known as the Yellow Lady Slipper. *Cypripedium Parviflorum* is present throughout North America but is currently on the Natural Heritage Program's "*List of Rare Plant Species of North Carolina,*" and is considered rare across its entire range (SR-T). In North Carolina, it is considered to be imperiled or critically imperiled (S1S2) and on a global scale it is generally secure but its varieties or subspecies may be vulnerable (G5T3T5). Botanists have described three varieties (var. *parviflorum*, var. *pubescens*, and var. *makasin*) based on observed ecological and morphological differences, but these groupings can be difficult to differentiate. This research aims to construct genetic markers that can be used to measure genetic diversity of the species and facilitate differentiation of varieties.

P52 - Low-tech seed enhancement technology could improve germination and establishment of longleaf pine understory perennial forbs.

Madeline Schmuck, Michael DiSilvestro, Danny J. Gustafson

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Reintroducing native plants into restoration and revegetation projects could increase plant species diversity, increase floral resources for pollinators, and positively affect trophic-level interactions in the community. Direct seeding into restoration projects has generally had poor success rates due to biotic and abiotic factors, leading to significant seed wastage of the already insufficient native seed supply. Seed balls (aka. seed aggregates, seed bombs, seed pellets) are a low-cost, low-tech seed enhancement technology where the seeds are encased in a soil and clay matrix, providing good seed-soil contact, controlling seed planting depth, providing nutrients, and possibly protection from seed predators. In our ongoing greenhouse study, we are testing 5.0 g seed ball shape (round vs disk) and cayenne pepper (+/-) on seed germination and establishment of native perennial understory species of the longleaf pine ecosystem. Three-way ANOVA of seedling counts (data collected on 11.28.23) show significant Species, Shape, and Cayenne Pepper main effects with no significant interactions. Observing species-specific differences in this preliminary analysis is common when working with native perennial plant species. There were significantly more seedlings established from disk vs. round seed balls and significantly fewer seedlings in seed balls with cayenne pepper. The greenhouse experiment is ongoing. We are following up on this research with a field study testing seed ball shape (round, disk) and cayenne pepper (+/-), initiated in December 2023.

P53 - Genetic diversity of the Timber Rattlesnake (*Crotalus horridus)* in Western North Carolina

Hudson Koch, Matt Estep

Appalachian State University, Boone, NC

Crotalus horridus, also known as the Timber Rattlesnake, is a pit viper whose range extends throughout the Eastern United States. These vipers typically inhabit deciduous forest areas and can be found throughout North Carolina where the species is listed as a species of special concern. This study aims to describe the genetic diversity and population structure of Western North Carolina populations. Using seventeen previously published microsatellite markers, a total of 126 individuals were genotyped using sheds. The study will present estimates of genetic diversity and population structure. This type of data is critical in determining the health of the Western North Carolina Timber Rattlesnake population and can be used to direct management activities for the species.

P54 - Analysis of Native Venus Flytrap's Fungal Associations

Anna Carnaggio[1], Michelle Barthet[1], Brandon Shaw[2], Jon Millet[3]

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The Venus flytrap (*Dionaea muscipula*), a symbolic carnivorous plant, potentially exhibits symbiotic interactions with fungi. Venus flytrap leaf-traps and roots were examined from a native population to assess potential fungal endophytes and mycorrhizae. Microscopy of root sections identified formation of arbuscular-like intracellular structures suggestive of mycorrhizal fungal associations. Molecular analysis of fungal cultures from Venus Flytrap roots and leaf-traps revealed distinct fungal profiles with only three fungal species identified from roots and a much broader taxonomic diversity of fungi from leaf-traps. Interestingly, identified root fungal species are not known mycorrhizae but pathogens or root endophytes serving distinct plant-symbiont roles. Identified leaf endophytes include potential biocontrol agents and other mutualistic species. This research sheds light on the complex fungal relationships to native Venus flytraps. Recognizing these multifaceted associations offers insight into plant-microbe interactions, with implications focused on conservation strategies.

P55 - Anthropogenic Disturbances and their effect on Ghost Crab (*Ocypode quadrata*) Burrow Architecture

Aaron Wiggs, Chelsea Thornton, Justin Puckett, Jeremiah Henning

University of South Alabama, Mobile, AL

Atlantic Ghost Crabs, *Ocypode quadrata*, are environmental engineers that serve as bioindicators of human impact on coastal beach ecosystems. *O. quadrata* is a common and abundant species ranging from Rhode Island to Brazil that serves as a crucial prey item for coastal birds and mammals. This semi-terrestrial invertebrate excavates burrows as a means for shelter in sandy environments. Burrow construction is an energetically costly process that is affected by different environmental stressors such as predation, beach morphology, and human disturbance. To better understand how *O. quadrata* burrow architecture responds to increased coastal urbanization and tourism, we collected plaster casts of burrows from seven beaches across the Northern Gulf Coast region that differ in intensity of human impact. Sites selected ranged from secluded sites with limited access to heavily impacted sites in tourist heavy areas such as Destin, Fl. Casts were measured for volume, angle of inclination, complexity, and depth, which can be impacted by human disturbance. Overall, we found relationships between the collected ghost crab burrows' volume, number of openings, depth, and branching among sites in relation to level of human impact. Further, at three sites experiencing extreme levels of impact in coastal Mississippi, we struggled to find enough burrows in order to sample burrow architecture, thus highlighting the precarious position of this ecologically significant species in a rapidly urbanized landscape. By analyzing how the burrowing behavior of *O. quadrata* varies in relation to anthropogenic disturbance along the Gulf Coast we hope to determine a predictable response in conjunction with related studies to support the efficacy of this method in evaluating the role of human impact in disrupting these coastal habitats. This study highlights the

critical role that *O. quadrata* serves in assessing the impact of anthropogenic disturbance can and will continue to have on coastal dune beach ecosystems.

P56 - Analyzing Reproductive Potential in Natural Marshes for *Spartina alterniflora* in Coastal Georgia Salt Marshes

Barbara Comer, Victoria Toro, Sydnee Juleus, Liberty Redtfeldt, Heather Joesting

Georgia Southern University, Savannah, GA

Spartina alterniflora, also known as smooth cordgrass, is a species of perennial grass native to the Atlantic and Gulf coast of North America. This plant plays a crucial role in salt marsh ecosystems and serves as a vital habitat for diverse wildlife, including migratory birds, fish, and other species. The presence of *S. alterniflora* helps stabilize the soil, prevent erosion, and provide a nursery area for many marine animals and *S. alterniflora*-dominated marshes can mitigate hurricane storm damage in coastal cities such as Savannah, Georgia. Due to its vital role in the salt marsh, the planting of *S. alterniflora* is often part of restoration projects aimed to support local biodiversity and enhance the resilience of coastal ecosystems in the face of environmental challenges. The purpose of this research was to investigate the reproductive potential of *S. alterniflora* to support the nursery production of this species for restoration activities. The methods used for this project include analyzing differences in reproductive potential (i.e., number of seeds and germination rate) between short and tall form *S. alterniflora* and in undisturbed and disturbed marshes. Specifically, seeds were collected from short and tall form individuals from two marshes to compare between growth forms, as well as from an undisturbed and disturbed marsh to determine the role of anthropogenic disturbance on reproduction. Once seeds were collected from each location, the number of seeds on each spikelet was counted in order to determine the average seed count for each location. Seeds were then placed in cold, wet conditions for winter stratification. Beginning in January, we will begin collecting data on the percentage of filled seeds per spikelet and germination rates. The results of this research will facilitate the nursery production of *S. alterniflora* by providing information on optimum sites for seed collection.

P57 - Impacts of soil amelioration on plant communities: From buried building to native meadow restoration.

Madeline Morrell, Talia Cartafalsa, Rachel Collins

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Landfills containing construction waste create degraded areas that are often dominated by non-native species. These areas tend to have low-quality soils that are highly compacted. Restoration with native plants has the potential to improve ecosystem functions and services. In this study we examined how two years of site preparation prior to planting native species on a construction debris landfill altered the plant communities. As part of the site preparation, we ameliorated different areas of site with compost, topsoil, and no ameliorations. We found that the total amount of plant biomass decreased between pretreatment and post treatment but the amount of biomass on areas ameliorated with composted increased. Additionally, forbs decreased in relative abundance.These results suggest that areas treated with compost will have greater biomass after seeding with native species. Our work supports growing consensus that a significant challenge to grassland restoration is controlling invasive grass species.

P58 - Understanding how *Apis mellifera* influence pollinator-microbe interactions

Christopher (Gage) Bell, Dr. Grace Freundlich

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Non-native pollinators have been known to outcompete native pollinators for floral resources. Pollinators have specific interactions with flowers that can provide redundancy when it comes to the floral microbe community. In the world of pollinators invasive honeybees have become more common because of their high pollination rates and their ability to outcompete non-social pollinators. With higher frequencies of pollinators such as honeybees the floral microbe community is in danger of becoming less diverse and negatively impacting native pollinator interactions. In this study, we studied plant-pollinator-microbe interactions in *Hypochaeris radicata* situated next to a honeybee apiary. This plant is widely available in open meadows and is visited by a variety of pollinators. We observed the presence and composition of pollinators during peak flowering in May and June of 2023 and recorded changes in floral microbe abundance and differences in floral rewards. Surprisingly, we did not observe differences in bacterial abundance or floral rewards as we changed the distance from the apiary. However, we did observe a significant shift in pollinator composition as distance increased. While most pollinators near the apiary were honeybees, we observed more hoverflies and other native pollinators as distance increased. We hope this work will continue to inform future studies investigating how pollinator community composition can impact floral microbes and shifts in floral rewards.

P59 - Survey of Disjunct Red Spruce (Picea rubens) Stands in the Rich Mountain and Alarka Laurel Basins, North Carolina

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In the southern Appalachians, disjunct populations of red spruce (*Picea rubens*) persist at low latitudes. These populations, at the southernmost end of their range, are likely the first stands to experience the impacts of climate change. This study aims to assess the health and recruitment of the Rich Mountain and Alarka Laurel spruce bog basins in Nantahala National Forest, North Carolina. The

surveys assessed red spruce and stand dynamics to provide baselines for future studies. Using five 10 m wide belt transects per basin, we conducted surveys of the overstory and spruce saplings and seedlings. Overstory and sapling red spruce diameter at breast height (DBH), height of seedlings, and the health of all spruce were measured. We recorded the DBH of all overstory species ≥10 cm. Red spruce was the dominant overstory species, representing an average of 25.6% of all measured overstory trees. Great rhododendron (*Rhododendron maximum*) and mountain laurel (*Kalmia latifolia*) were dominant in the shrub layer, limiting open sky exposure. Seedlings and saplings were present throughout the basins, accounting for 72.8% of red spruce. Overall, red spruce were healthy, with some variability between age categories. These two red spruce populations are currently stable with healthy trees and large seedling banks and appear to be not yet affected by climatic warming, despite the southern latitude and relatively low elevation.

Key Words: Picea rubens*; recruitment rate; southern Appalachian Mountains; spruce bog; stand dynamics*

P60 - Using Science Sprints to teach research skills: How is biodiversity affected by urban development?

Jennifer Kovacs

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Eighty years ago, the federal Home Owners' Loan Corporation created "Residential Security" maps for over 100 major American cities. These maps graded neighborhoods on an A-D scale with "A" neighborhoods being desirable for investment and "D" neighborhoods being deemed hazardous. This redlining practice denied the minority residents in these "hazardous" areas access to capital investment. While outlawed in the 1970s, the long-term impacts of redlining can be seen across urban areas in the US today. For this project, we are asking how differences in urban development due to redlining affect bird biodiversity? We used birdwatching community science data collected by Project eBird to analyze bird counts from locations within urban counties that have been historically redlined. Our analyses focused on major metropolitan cities in the Atlantic Flyway between 1990 and 2020. We used R to download, clean, and analyze raw citizen science data to provide a measure of overall bird biodiversity, measured by species richness and the Shannon's Diversity Index. Using ArcGIS to overlay historical redlining maps, we analyzed the relationship between the redlining grades and the recent patterns in bird diversity. We compiled much of this data during a one-day Science Sprint held in April 2022, in which ASC students learned and used R and GIS to clean up and analyze the bird and redlining data for a single city and year. We then compiled data from all the completed cities to gain a better idea of the large-scale regional effects of redlining on biodiversity.

P61 - Thriving on the Threshold: Royal Catchfly (*Silene regia*) exhibits increased growth and reproduction along a forest-edge gradient in a remnant prairie community in Georgia

Megan Brooks, Mario Bretfeld

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In the state of Georgia, a long history of fire suppression, land use conversion, and habitat fragmentation led to the decline of once widespread prairie ecosystems and in turn the plant life which inhabit them. The Royal Catchfly (*Silene regia)* is a perennial forb known to grow in rocky, basic soils which was once prevalent through the midwestern and southeastern U.S. (with Georgia being the southern boundary of this range) but has declined significantly in Georgia where it is now classified as an S1, or critically imperiled species. Attempts at reintroduction via out planting have only shown limited success, necessitating more research on the environmental conditions in which this plant survives in its southern-most distribution. From April to August 2023, after a prescribed burn in February 2023, we collected data on growth, reproduction, and edaphic conditions along a forest edge in one of the last remaining native populations of *S. regia* in Georgia. Our results are indicative of an edge effect, wherein individual plants display significantly higher growth and flowering/fruiting(flower count was 52% higher, while fruit count was 48% higher at its peak) within 1 meter of the forest-prairie boundary when compared to further into open prairie or forested zones. Soil pH throughout the site was uniform and neutral, ranging from 6.7-7.4. While this is unexpected of this prairie plant in its northern distribution, high seasonal temperatures that are typical for Georgia could induce stress in this species in its southernmost distribution. Our findings are important for future conservation efforts to increase chances of success in managing this species, especially given the predicted changes in climate conditions.

P62 - Constraints and Mechanisms of Virginia Barrier Island Migration in Response to Sea Level Rise

Ryan Hearl, Julie Zinnert

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The Virginia barrier islands are highly susceptible to erosion from intense winds, storm events, wave force, and sea level rise (SLR) which are increasing in frequency and magnitude as climate change continues. These islands protect Virginia coastline and marshland by serving as the first line of defense against phenomena associated with SLR. Therefore, it is important to understand how the islands will be affected by climate factors and mechanisms that inform migrational response. Barrier island migration is a documented response to SLR, where wind and wave transported sediment accumulates on backbarrier marsh, while the shoreface moves landward. Our objective is to evaluate the influence of landscape composition and land cover class change on barrier island migrational response for nine, undeveloped VA barrier islands. Using five land cover rasters derived from LandSat imagery between 1984 - 2021, we analyzed relationship between upland width, class amount (i.e. grassland, woody, marsh, and bare), and class change to rates of marsh to upland conversion within transects drawn in ArcMap. It is hypothesized that greater width and upland area will have lower migration rates, while marsh area will determine the extent to which migration can occur. Vegetative barriers in the upland are likely to block wind blown and overwashed sand, preventing sediment deposition needed for migration. Our analysis examines the relationships between land cover composition and island migration rates and evaluates results at both the island and transect scale. The transect scale may be more informative on sub-island dynamics due to the importance of localized effects, like woody vegetation expansion on several islands.

Answering these questions allows for predictions of future island ecosystem states and application to management under different climate change scenarios.

P63 - The Effects of Brown and Rainbow Trout on Native Fish Populations in Low Order Streams in North Georgia, USA

Grace Lansdell

Truett McConnell University, Cleveland, GA

Naturally occurring populations of trout in Georgia are not well established due to low calcium levels in the soil, so non-native brown trout (Salvelinus fontinalis) and rainbow trout (Oncorhynchus mykiss) are stocked in Georgia streams to meet angler demands. Trout fishing brings in $172 million a year to Georgia, and over 100,000 licenses are sold. However, previous studies have suggested stocking streams with non-native trout has negative effects on native fish populations. Hypotheses for this study predicted that native fish assemblages in trout streams are different in species evenness, richness, abundance, and composition than native fish populations without trout. We electrofished ten 90 meter reaches, sampling in two trout streams and two tributaries in North Georgia. We used the statistical method bootstrapping to produce 10,000 random samples for each reach, comparing the native fish populations to their respective tributaries, which contain no trout. For a reach to be considered part of the tributary population, it had to be similar in two of the three criteria: species evenness, species richness, and species composition. This was determined by using a two-tailed test and rejecting any criteria with a p value < .05. We rejected 6 of 8 trout reaches, meaning they did not meet the criteria to be considered part of the tributary population. Also, total fish abundance greatly decreased with increasing trout abundance for both stream systems. These findings suggest that trout may negatively affect native fish abundance, evenness, species richness, and composition. While this study is small in sample size, it is indicative that more research needs to be done to fully understand how stocked trout affect native fish populations in stream ecosystems. The economic value that stocked trout bring to Georgia cannot be underestimated and is important to consider when making conservation decisions.

P64 - Branching Out: An Evaluation of Short-term Coarse Woody Debris Decomposition in the Southern Appalachians

Rylee Strassner, Ashley Adams

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Coarse woody debris (CWD) stores nutrients, releases energy, and provides a home for many fauna. Often, researchers focus on the long-term effects of CWD decomposition while ignoring the importance of the initial decay stages. The objective of this study is to determine the quantity and quality of CWD within each forest type, understand the effect of nitrogen enrichment on short-term CWD decomposition, and evaluate soil samples to determine if there are any differences in soil carbon storage. I hypothesize that I will see more CWD in the deciduous-dominant forest type due to successional competition and that nitrogen enrichment will slow the rate of CWD decomposition. With these predictions, I anticipate differences in soil carbon storage between the two forests. The study site is located in the Southern Appalachians and contains both coniferous- and deciduous-dominant forest types. I will observe the amount of CWD in each forest type and assign decay classes to each piece of CWD. I also have a small experimental plot to test the effects of nitrogen enrichment on short-term decomposition by having pre-cut logs sampled at different time points. Here, I will take soil samples before and after CWD decomposition occurs to evaluate the amount of nutrient deposition into the immediate soil that occurs. With an understanding of the similarities and differences between coniferous and deciduous short-term CWD decomposition, it can be determined which forest type retains the most carbon initially after death and whether future increases in the deposition of atmospheric nitrogen will affect how much carbon is being transferred into the soil. At this conference, I will present results from my initial CWD surveys from coniferous and deciduous forests this winter. I will also show relevant background information, my hypotheses, and important methodology.

P65 - Evaluating the success of a dune restoration on Tybee Island, Georgia: monitoring sand movement and plant community dynamics

Skyler Fox, Travis Williams, Lissa Leege

Georgia Southern University, Statesboro, GA

Coastal sand dunes provide numerous ecosystem services, including creating a barrier for coastal communities against storm surge, sequestering carbon, and providing wildlife habitat. Tybee Island is Georgia's northernmost barrier island and receives two million visitors annually. This coastal city developed a Sea-Level Rise Adaptation Plan in 2016 to help combat the negative effects of sea level rise and increased storm events as a result of climate change. A part of this plan entailed constructing a half-mile-long, eight-foot tall sand dune and planting six native dune species, including 271,000 Uniola paniculata (sea oats) seedlings, to vegetate the dune in 2020. In partnership with the City of Tybee, the Leege Lab at Georgia Southern University developed a monitoring protocol to evaluate the success of the restored dune compared to the dunes that were previously present on the island, with the ultimate goal of protecting Tybee's investment in the restored dune. This protocol involves taking quarterly measurements at locations throughout the restored and established dunes to evaluate sand movement, species richness, and percent vegetation cover. Two years following dune restoration, Tybee's sand dunes accumulated on average 19.2 ± 2.89 cm of sand over the year. Sand accumulation did not differ between the established dune and the restored dune but was 3.45 times higher at the dune toe than at the dune crest. Additionally, in Fall 2023, the restored dune crest had only one-third the vegetation cover relative to the established dune crest. These results suggest that while the restored dune toe is performing natural processes indistinguishable from the established dune, as measured here, the restored dune crest is not yet providing equivalent ecosystem services. It will be important to continue monitoring this dune restoration in order to evaluate any additional management strategies necessary to ensure its full success.

P66 - Quantifying plant functional diversity and composition between coastal dune communities

Isabelle Pillow, Andrew White, Ryan Hearl, Julie Zinnert

Virginia Commonwealth University, Richmond, VA

Coastal dune research often focuses on dominant dune building species as they share similar characteristics or taxonomic similarities across large spatial regions. Less attention is given to dune communities and the functional composition at the community level. Dominant species differ in functional traits, reflecting multiple strategies to exist in the dune environment while also influencing dune building. Functional traits account for both above and belowground processes like resource capture and sediment accretion, but are poorly quantified at the community level. The objective of this project is to quantify and compare the functional diversity and composition of geographically distant coastal dunes. We hypothesized that dunes differing in species assemblages will have similar functional trait composition. Field work was conducted at Hog Island, part of the Virginia Coast Reserve Long-Term Ecological Research site and the US Army Corps of Engineers Duck Field Research Facility in Duck, NC. We found functional diversity and dispersion to be lower at Hog. Differences in community weighted mean traits between Hog and Duck could influence sediment capture (such as rhizome number and internodal length). We observed differences in alongshore accretion between the sites, with more variable sediment accretion at Hog. These results indicate the importance of plant functional traits to dune building processes. Characterizing these differences through the functional composition approach can help improve models predicting dune dynamics in coastal systems.

P67 - Differences in soil communities at longleaf pine restoration sites

Dylan Bennett, Olivia Walker, Rylee Shaw, Isabella Vahle, Paula Jackson

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The longleaf pine (*Pinus palustris* Mill.) ecosystem is one of the most diverse and endangered temperate ecosystems in the world. Reasons for its decline include overlogging, agricultural land use, and fire suppression following European colonization. Restoration efforts in the longleaf pine ecosystem have since increased. Sites with preexisting longleaf can be managed primarily with prescribed fires, while other areas without established longleaf require planting and more aggressive management techniques. Bacteria and fungi in the soil surrounding plant roots are important for various plant functions, including fighting viruses, aiding in water and nutrient acquisition, and facilitating plant growth. Little is known about how differences in longleaf pine age impact associated soil microbes. Our study was conducted at two longleaf pine restoration sites: Sheffield Wildlife Management Area (WMA) and Paulding Forest WMA, both located in Paulding County, Georgia. The sites have similar herbaceous community structures and have been under restoration for about 25 years but differ in stand age due to differences in site history. Sheffield WMA consists of mature longleaf pine with second-generation growth present, whereas Paulding Forest WMA consists of only young, first-generation longleaf pine. Six randomized plots (2.4 m2) were set up at each site. Each block contained an undisturbed subplot (50 cm2) from which we collected soil samples. DNA was extracted from these soil samples using a commercially available soil DNA extraction kit. The DNA was quantified and then sent to LC Sciences for PCR amplification of bacterial and fungal genome sequences. Our preliminary results indicate a significant difference in the soil bacterial and fungal communities between restoration sites, pointing towards the influence of stand age on the soil microbiome. These results will help inform how stand age and restoration practices affect soil microbial communities, which can be indicators of plant and soil health.

P68 - Documenting the Fire History of Pilot Mountain State Park

John Guglielmetti, Esprit Cha, Dane Kuppinger

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Fire impacts the biodiversity, structure, and function of many ecosystems across the Southeastern United States. While large scale fires are uncommon in the Piedmont, the presence of fire adapted and dependent species within dry forest communities indicates that they have helped shape these communities. Unfortunately, few fire history studies have been conducted in this region. Fire suppression policies in place nationally from 1930-1980 resulted in decreased fire frequency in the southeastern Piedmont, but effects upon fire community composition and dynamics remain understudied. Work in some western forests suggests that fire suppression may lead to larger and more intense fires when they do occur but whether this is true for the Piedmont has not been fully explored. This research builds upon a previously published fire history for Pilot Mountain State Park, extending that history back to 1826 through the inclusion of 37 additional samples. The combined dataset now documents 45 fires; 22 during the pre-suppression period (1826-1929), 12 during the suppression period (1930-1980), and 11 during the post-suppression period (1981-2023). The Mean Fire Interval (MFI) increased from 2.48 to 4.36 during the suppression period and declined to 3.36 for the post-suppression period. Fires in the pre-suppression period had a larger mean size (542,287 m2) than fires during the suppression (39,611 m2) and post-suppression periods (57,696 m2). This data provides additional evidence that current fire management policies are not recreating the fires that were present under previous management regimes.

P69 - Dual Analysis of Biomass and Carbon Sequestration in Secondary Successional Forests in the Piedmont of North Carolina Utilizing Geographic Information Systems and Field Truthing Methods

Chloe Stuart

Elon University, Verona, NJ

As levels of atmospheric carbon continue to rise, so does public concern about climate change; however, not enough is being done to prevent further damage to our planet. While the scientific community turns its attention toward high-tech solutions, many local

conservation options are being overlooked, such as the carbon mitigation opportunities offered by local parks. This research looks at carbon sequestration, the process of trees absorbing and holding onto atmospheric carbon, in Cedarock Park in Alamance County, North Carolina to help better understand the capabilities of county parks to mitigate climate change. During the summer of 2023, prism cruising was employed to collect diameter data from trees <10 cm diameter at breast height (DBH) from 87 randomly selected plots. Precise geographic coordinates were recorded using Google Maps. Subsequent analysis involved calculating tree density, species richness, and Shannon's H' diversity index for each plot. Geographic information systems technology was used to obtain elevation (in meters), slope (in degrees), and aspect (in degrees). Our results demonstrate that Cedarock Park stores between 163-181.1 MG/ha CO2e, a significant contribution to local carbon sequestration efforts. This figure aligns favorably with other forests in Alamance County, such as Elon University Forest (88.6-98.5 Mg/ha), Cane Creek Mountains Natural Area (190.7-211.9 Mg/ha)) and US Forest Service estimates of carbon storage in Piedmont forests. No significant correlations were found between carbon storage and elevation, slope, aspect, tree species richness, or diversity. Cedarock Park, due to its classification as a secondary successional forest, is likely to possess even greater carbon sequestration potential than currently estimated. This study underscores the overlooked role of local parks, exemplified by Cedarock Park, in mitigating climate change.

P70 - Clinch River Freshwater Mussel Dietary Preferences

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Freshwater mussels (Mollusca: Unionidae) play a crucial role in freshwater river environments where they live in multi-species aggregations and often serve as long-lived benthic ecosystem engineers. Many of these species are imperiled and it is imperitive that we understand their basic needs to aid in the reestablishment and maintenance of mussel beds in rivers. In an effort to expand our knowledge of the diet of these organisms, five species of mussel were introduced into enclosed systems in two experiments. In the first, mussels were incubated in water from the Clinch River (Virginia, USA) and in the second, water from a manmade pond at the Commonwealth of Virginia's Aquatic Wildlife Conservation Center in Marion, VA. Quantitative PCR and eDNA metabarcoding were used to determine which planktonic microbes were present before and after the introduction of mussels into each experimental system. It was found that all five species preferentially consumed microeukaryotes over bacteria. Most microeukaryotic taxa, including Stramenopiles and Chlorophytes were quickly consumed by all five mussel species. We also found that they consumed fungi but not as quickly as the microalgae, and that one species of mussel, *Actinonaias pectorosa*, consumed bacteria but only after preferred food sources were depleted. Our results provide evidence that siphon feeding Unionid mussels can select preferred microbes from mixed plankton, and mussel species exhibit dietary niche differentiation.

P71 - Heavy Metal Analysis on Freshwater Turtle Species: Examining the Effects of Industry in Dalton, Georgia.

Logan Pavlik, Emilie Leyssens, Delma Miguel, Courtney Hampton, Rebecca Brosky, Christopher Manis

Dalton State College, Dalton, GA

Dalton, Georgia, is a hub for the textile industry, and historically, the industry has used heavy metals such as cadmium and lead in the production of carpet dyes. The previously mentioned metals are the subject of our analysis in this study. Typical freshwater turtle species are long-lived organisms, making them well-suited for bioassays on the accumulation of heavy metals in aquatic environments over time. Turtles were collected using three-foot hoop nets. Nonlethal samples were taken from the posterior of their carapace and claws. Turtles were processed and released immediately on site. Chelonians were sampled at two study sites: one in Dalton, Georgia, and the second in Ringgold, Georgia, on private property that has cattle actively grazing, serving as a comparison site. Claw and carapace samples were analyzed for total recoverable metals using microwave digestion and ICPOES. Turtles can be helpful bioindicators for wetland ecosystems when considering the accumulation of heavy metals such as lead from the urban industrial complexes that surround them.

P72 - To eradicate or to manage exotic watercress in our campus stream: a benthic macroinvertebrate study addresses this dilemma

John Delfino

Midway University, Midway, KY

Two exotic species of watercress (*Nasturtium officinale and N. microphyllum*) exist in Kentucky waterbodies. Watercress is the predominant herbaceous vegetation found in the Lee Branch stream on our Midway University Campus. Minimizing the streamside buffer in Summer 2021 allowed watercress to "explode" in coverage, typically choking out this waterbody. The dilemma is, to eradicate or to manage watercress. This study was conducted June 9-September 30, 2022. The ≈ 1338 m stream reach was divided into 3 segments, with watercress beds randomly sampled in each segment. The objectives were to determine abundance of benthic macroinvertebrates and number of groups found therein, to compare benthic macroinvertebrate group richness in habitat type provided rarefaction curves permitted, to evaluate for an association between habitat type and benthic macroinvertebrate group pollution sensitivity, and to speculate on benthic macroinvertebrate group evenness in habitat type. For benthic macroinvertebrate sampling, watercress was manually pulled (roots, stems, leaves) from underlying substrate, placed in a 5-gallon bucket containing stream water, brought back to the lab where contents were sieved, specimens identified and preserved; living crayfish returned to sampling locations. In summer 2023, watercress was sampled to be exclusively *N. officinale* and assumed to be such retroactively for the 2022 study. A total of 10,808 benthic macroinvertebrates representing 81% of groups looked for inhabited watercress beds. There was no significant association between habitat type and benthic macroinvertebrate group pollution sensitivity. Benthic macroinvertebrate group richness was runs > pools >

glides; no significant difference. Shannon evenness index for benthic macroinvertebrate group was glides > runs > pools; no significant difference. Combined results suggest watercress beds be managed (not eradicated) particularly in both pools and glides by manually thinning each to increase stream flow promoting for increase in or maintenance of richness and evenness within habitat type and in downstream habitat types.

P73 - From landfill to native meadow: Examining impacts of pre-restoration work on soil attributes

Ashley Curtice, Talia Cartafalsa, Rachel Collins

Roanoke College, Salem, VA

Over the past several decades, restoration of landfill sites has emerged as a way to convert degraded landscapes to areas that are able to perform ecosystem functions and services. There are many benefits to landfill restoration such as increasing biodiversity, improving the soil profile, and the opportunity to establish native vegetation. In 2014, Roanoke College demolished a residence hall and buried the building remains on a 1.4-hectare site on their Elizabeth Campus grounds, turning it into a landfill site. As is common with landfill sites, the soil is highly compacted, vegetation is sparse, and invasive species dominate the plant community. Our goal is to restore the landfill to a native meadow, increase productivity, and promote native species diversity. Here we assessed how our site preparation and soil amendments changed the attributes of the soil. For site preparation we loosened the topsoil layer, added topsoil and or compost and mixed the surface material. We measured depth using a tile probe for penetration, soil pH, total carbon, and total nitrogen before and after site preparation. Consistent with expectations, tile probe depth increased on the north side of the meadow and decreased on the south side. Average pH did not significantly change. Total carbon and nitrogen changes were consistent with site preparation work. This work will allow us to determine best practices for similar restoration projects in the future.

P74 - Sweep-net vs. kick-net – comparing the effectiveness of two sampling methods in assessing benthic macroinvertebrates

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Benthic macroinvertebrates are commonly sampled to assess water quality in streams using a variety of methods, targeting different stream habitats. This study sampled macroinvertebrates from 12 sites across the Lawson's Fork Creek watershed in South Carolina using sweep-net and kick-net sampling, which targeted submerged plant roots and rocky, turbulent riffles, respectively. Since these methods are commonly used by state agencies, the goal of the study was to determine which method was better at estimating overall stream biodiversity on its own, if at all. For each site, macroinvertebrates were collected using each method, identified to family, and assessed for various indices of biodiversity. Results were compared against each other as well as the entire sample site. Seven biodiversity indices were assessed: total taxa richness, EPT richness, Diptera richness, tolerant taxa richness, intolerant taxa richness, the Shannon-Wiener Diversity Index, and Hilsenhoff's Biotic Index. It was hypothesized that kick-net sampling positively impacted index values while sweep-net sampling negatively impacted them, and kick-net sampling would produce values closer to site total. Significant differences between sweep-net, kick-net, and site total values were found for all indices, but the directionality of the sampling methods' impacts, as well as which method produced results closer to site total, varied widely across them. Neither method can be said to better represent overall site biodiversity, though for some individual indices, such as intolerant taxa richness and Shannon-Wiener Index, kick-net or sweep-net method, respectively, provided a significantly closer value to site total. From these results, it was concluded that neither net-sampling method is more effective for broadly assessing a stream's biodiversity, and utilizing both of them is desirable when possible. However, if only a single index of biodiversity is being assessed, one method may be better than the other depending on the index.

P75 - Establishment and Growth Patterns of Southern Appalachian Carolina Hemlock Ecosystems

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Carolina hemlock (Tsuga caroliniana), an endemic species to the southern Appalachian Mountains, has vast ecological value because of their associated ecosystem services such as avian nesting sites, wildlife food, and winter shelter. The non-native, invasive hemlock woolly adelgid (Adelges tsugae) has threatened the health and longevity of both Carolina and eastern hemlocks (Tsuga canadensis) in the Appalachians since their establishment in the early 1950's. Climate change may worsen this threat as warming temperatures may promote adelgid infestations as well as alter hemlock habitat. Compared to eastern hemlock, less is known about the establishment and growth dynamics of Carolina hemlock. We used dendroecological methods to describe these patterns for five Carolina hemlock populations in North Carolina and Tennessee using 1,250 tree cores. The majority of the Carolina hemlock establishment dates within the five sites were concentrated between 1920 and 1990 and tapered off such that by 2000 no recent establishment had occurred. Major and minor growth release events are present in the hemlock populations across the sites. Our next step is to correlate these releases with climatic and disturbance records, to gain a better understanding of how this unique ecosystem persists. Understanding the structure, composition, and establishment patterns within and across these sites is important for figuring out if Carolina hemlock growth will be sustainable with a changing climate and an increase of the deadly hemlock woolly adelgid.

P76 - A Survey of Aerial and Aquatic Arthropod Diversity Between Reference and Degraded Fluvial Wetlands in the Little Tennessee River Floodplain

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Wetlands are well-known for ecosystem services that benefit humans such as water filtration, flood control, and the prevention of erosion. They also serve as habitats for species of plants and animals that cannot survive elsewhere. Despite their importance, many wetlands have been drained, filled in with sediment, polluted, or otherwise degraded and destroyed by human activity. In the Southern Appalachians especially, variable topography limits many wetlands to the floodplains of river valleys where they were often converted to farmland because of their rich soils. These fluvial wetlands are under-studied compared to other types of wetlands in the mountains, like mountain bogs, largely because they are on private lands. In aquatic systems, arthropods are often used as bioindicator species due to the ease with which they can be collected and their sensitivity to disturbances. We measured arthropod diversity and water quality measurements to compare the health of two reference fluvial wetlands and four degraded fluvial wetlands slated for restoration in the Little Tennessee River floodplain. Between June and October 2023, we conducted weekly water quality measurements, monthly malaise trap samples, and two rounds of benthic macroinvertebrate sampling at each of the six wetlands. In addition, we surveyed dragonflies and damselflies: adults were identified and counted weekly, and juveniles were collected by dipnetting. By collecting these data, we intend to determine whether there is a relationship between arthropod diversity and the overall health and quality of wetlands. The results could have implications for how future restoration efforts are measured.

P77 - Alligator weed produces seeds in North America: Implications for invasive alligator weed reproduction.

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Fruiting and seed production in some flowering plants are affected by the external environment, but these processes are complex and multifaceted. Alligator weed (*Alternanthera philoxeroides*) has spread extensively as an invasive species on multiple continents, but its capacity for sexual reproduction seems greatly diminished in the invaded range. Reports of alligator weed seeds and fruits in the invasive range remain sporadic and no instances of viable seeds in invasive alligator weed have been confirmed. While breakdowns in sexual systems have been reported in other invasive plants, there has been little investigation into the sexual reproduction of invasive alligator weed. In 2022, two instances of invasive alligator weed fruiting and seed production were observed in disparate communities in northern Mississippi. While no fruiting was observed in aquatic alligator weed, both instances of fruiting were observed in terrestrial conditions. Additionally, alligator weed in the western site exhibited taproots which are only expressed in the terrestrial growth form. This suggests terrestrial conditions as a requirement for fruit and seed formation in alligator weed. Germination was attempted on seeds collected from these sites, but all efforts resulted in failed germination. Seeds also showed signs of maldevelopment. A potential cause of failed germination may be a genetic factor that renders these populations incapable of viable seed production (e.g., low genetic diversity, inbreeding depression, or polyploidy). This record of alligator weed seeds is the first in over forty years in the US. These findings suggest that further investigation into alligator weed sexual reproduction is needed.

P78 - Assessing Atmospheric, Hydrological, and Biological Connections of Microplastics in Southern Appalachian Headwater Streams

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Microplastics (MPs) are ubiquitous and recent studies report alarming concentrations of MPs in the atmosphere, in both terrestrial and aquatic systems, and within living organisms. However, few studies have tried to link potential sources of MPs to concentrations found in aquatic systems and ultimately the organisms that dwell in those systems. We assessed the depositional rates of MPs from the atmosphere as well as the abundance of MPs within two predominantly forested headwater streams within the upper reaches of the Cullasaja River watershed in Highlands, North Carolina during the fall of 2023. Caddisflies (Trichoptera: Hydropsychidae) and their casings were also sampled in the streams. Atmospheric deposition was highly variable, ranging from 0 to 384.8 MPs/m^2/day, with mean wet atmospheric deposition (105.8 MPs/m^2/day) considerably higher than mean dry atmospheric deposition (31.5 MPs/m^2/day). The two sampled headwater streams had similar mean concentrations of microplastics (19.5 MPs/L and 17.9 MPs/L) during baseflow. We found a slightly higher concentration of MPs in caddisfly larvae (0.8 MPs, n=30) than in their casings (0.5 MPs, n=30). Across all samples, blue MPs were the most common, followed by black; fibers were the most common type of MP. Similarities in the character (color, type) of microplastics found in atmospheric, stream water, and caddisfly samples provide strong evidence that atmospheric deposition serves as the primary source of microplastics in headwater streams in the southern Appalachian Mountains.

P79 - Investigating Fish Community Diversity Within The Urbanizing Watershed of Lawson's Fork Creek

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Fish communities in the Southeastern U.S. have experienced biodiversity loss due to conversion of lands to agricultural, industrial, and residential uses. Although initial loss of sensitive and intolerant native fishes may occur quickly as land uses change in a watershed, there is a lack of research on the effects of urbanization on the more tolerant species remaining in fish communities and how they respond to continued effects of urbanization (i.e., increased stormwater discharge and bank erosion). Therefore, this study evaluated community composition through use of metrics such as species richness, species evenness, Shannon's diversity index, and index of biotic integrity (IBI) in comparison to physiochemical, habitat, and environmental factors of mainstem and tributary sites of the Lawson's Fork Creek basin in Spartanburg County. 1,505 fish were collected, and 24 species were represented across the 12 sites, and the means of the biodiversity metrics were not significantly different between tributary and mainstem sites (P=0.025), upstream or downstream position in the watershed (P=0.027), and impervious surface ranking (P=0.935). Principle components analysis suggested that differences in fish biodiversity among sites is influenced the most by drainage area but secondarily by the amount of impervious and urbanized area in a watershed. In addition, habitat quality and substrate composition were related to the amount of forested habitat upstream, influencing the species richness and fish diversity at a site. This study supports other findings which suggest maintaining impervious surface cover below a 10 - 15 percent threshold to conserve native fish biodiversity.

P80 - Evaluation of DNA extraction methods to examine freshwater mussel microbiome from four species of freshwater mussel

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Mussels are vital components of freshwater streams due to their role as ecosystem engineers. The mussel microbiome represents the microorganisms living in and on the mussel and can significantly impact organism health. Changes in mussel microbiome composition can help us learn about mussel ecology and the local conditions impacting mussel health, which can be instrumental in informing conservation efforts. In this study, mucus and hemolymph samples were collected in duplicate from four species of freshwater mussel found in the Tallapoosa River (Alabama) to examine species-specific differences in mussel microbiome composition. As a first step, in processing these samples, multiple DNA extraction protocols were performed on each sample type to determine the most appropriate method that would yield the best quality and highest concentration of DNA. These extracts will then be used for sequencing of the 16S rRNA gene to examine microbiome composition among these four species, and the most appropriate DNA extraction method will also be used for additional mussel samples collected from a variety of environmental conditions to examine how variation in local conditions can impact microbiome composition. Here we present the findings of this comparison of DNA extraction methods and hope to show preliminary results of the microbiome composition of the four species sampled initially.

P81 - Does Size Matter? Investigating the Role of Habitat size and Abiotic Heterogeneity on Wetland Plant Diversity in the Piedmont

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As global biodiversity continues to decline and conservation and restoration efforts are needed it is important to better understand the drivers of diversity. Conventional ecological thinking is that larger habitats inherently support greater diversity due to increased niche variety and reduced extinction risks. However, size alone does not guarantee higher heterogeneity. Despite this, conservationists often prioritize larger habitats over smaller ones, anticipating higher diversity. This study aims to delve into the relationship between habitat size and abiotic heterogeneity within a valuable southeastern ecosystem. Specifically, the research will focus on the impact of abiotic heterogeneity and habitat size on plant diversity in Freshwater Forested Wetlands in the Piedmont region of South Carolina. Early results from this research conclude that heterogeneity and size are not directly correlated. Smaller wetlands with increased heterogeneity seem to be able to maintain higher diversity patterns, just as larger wetlands that might be more homogenous. The implications of this evidence suggest that conservation policy should not focus solely on the size of the habitat but should also consider the heterogeneity of the environment because by not doing so we are forgetting smaller habitats that foster high diversity. Additionally, it points to the fact that in restoring a wetland, if your main goal is fostering higher species diversity, you can accomplish this by either creating a larger wetland through the traditional route or by building smaller wetlands with increased abiotic heterogeneity.

P82 - Antioxidant properties and biofuel potential of colonial green algae.

Joven Jose, Dr. Melba Horton

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Colonial microalgae such as *Pediastrum* and *Scenedesmus* of class Chlorophyceae are photosynthetic non-motile freshwater coenobium which have emerged as a promising feedstock for biofuel production and extraction of antioxidative bioactive compounds that could replace the present synthetic antioxidants due to advantages, such as high photosynthetic efficiency, rapid growth rate and high lipid content. Algal cell growth, lipid accumulation and synthesis of bioactive compounds are susceptible to environmental conditions and this study has inculcated the prevailing ecological condition of high phosphate concentration in Florida lakes given that the state supplies almost 80 percent of the country's phosphate needs. The purpose of the study was to determine the effect of phosphate (potassium phosphate) repletion on lipid production and antioxidant activity by DPPH and hydrogen peroxide radical scavenging biochemical assay on *Pediastrum* and *Scenedesmus* cells after 5 weeks of growth under controlled laboratory conditions. Results indicated that there is a statistically significant 17% increase in lipid content within colonial green algal cells at high phosphate concentration. All solvent fractions in this study efficiently scavenge free radicals, indicating that DPPH and hydrogen peroxide radical scavenging biochemical compounds with both hydrophilic and hydrophobic properties were dispersed in the aqueous residue and organic fractions of control and experimental treatments. Higher antioxidative compounds were observed at high phosphate concentrations compared to the control,

although statistically not significant. This aligns studies that show how high phosphorus concentrations can induce synthesis of biochemical compounds within microalgal cells. This study postulates that under high phosphate concentration, the mechanism of colonial microalgal production of polar and nonpolar compounds is enhanced as exhibited by the high lipid content and antioxidant production which compels for further investigation.

P83 - Benthic macroinvertebrate survey of the Conasauga River

Zoe Clark, Tyler McNeese

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The 93-mile-long Conasauga River has its headwaters in Georgia's Cohutta Wilderness, flows into Southeast Tennessee, and then bends south into Northwest Georgia. The biodiversity of the Conasauga is widely recognized with over 20 species of rare, threatened, and endangered fish and mussels inhabiting the river. While the upper reaches within the Chattahoochee and Cherokee National Forests are pristine, as the river flows through private lands it is affected by agriculture and development. Our research project assesses the benthic macroinvertebrate communities and water quality at seven sites in the northern portion of the Conasauga River, including sites within the National Forests and sites downstream. Our results will be compared with those from a survey of the same sites conducted in 1994 to determine if any significant changes have occurred over the nearly 30-year period. Habitat quality was assessed at each site and measurements included pH, dissolved oxygen, water temperature, turbidity, and conductivity. To assess the macroinvertebrate community, we used two different sampling methods. The semi-quantitative method involved disturbing the substrate of two 1 m^2 riffle areas immediately upstream of a kick net for 30 seconds. The qualitative method involved three people equipped with D-frame nets sampling as many different habitat types as were present within each site for fifteen minutes. Aquatic insects were identified to the family level. Benthic metrics calculated include taxa richness, Hilsenhoff biotic index, percent EPT, and percent contribution of the dominant taxa.

P84 - **I**nvestigations with **N**EON: **V**ariability of macroinvertebrates versus **U**rban and **R**ural **T**emperature dynamics in **S**treams (INVURTS)

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INVURTS is a pilot project of the Ecological Research as Education Network (EREN). We are currently engaged in the first, pilot year of data collection of what will be a multi-year project and are actively recruiting additional participants across the US. We are investigating the interactions of temporal variability of stream temperature and climatic (biome) and land-use effects on aquatic macroinvertebrate communities. To assess potential trends and interactions at this broad spatial scale, we plan to combine data from sites in the NEON network and sites at participating institutions to test three hypotheses: Hypothesis 1 (Intermediate Disturbance Hypothesis): More extreme (high or low) daily/seasonal/annual temperature variability may decrease biodiversity of stream macroinvertebrates due to species' limits; therefore, highest biodiversity is expected at sites with predictable intermediate levels of variability. Hypothesis 2 (Urban Stream Syndrome): Stream macroinvertebrate biodiversities in urban streams are more similar to each other across NEON Domains than to other sites within a NEON Domain, because as urban streams become more homogenized in their physico-chemical characteristics, including temperature regime, they become more similar in their community composition. Hypothesis 3 (Thermal Equilibrium Hypothesis): An optimum equilibrium between temperature & growth exists; therefore, populations of a species at suboptimal sites are expected to exhibit low population density and smaller individuals versus more optimal sites. To test these hypotheses, participants will collect year-round in situ temperature data in a wadeable stream, do habitat assessment surveys, and gather biological data (environmental DNA and/or macroinvertebrate specimen collection) for three seasons (spring, summer, and fall).

P85 - The role of sRNAs in Microcystis aeruginosa: Insights into Gene Expression and Environmental Acclimation

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Small RNAs (sRNAs) are non-coding transcripts involved in gene regulation across various life forms. However, the specific functions of sRNAs remain poorly understood in *Microcystis aeruginosa*. *M. aeruginosa* is a bloom-forming cyanobacterium that is capable of producing the hepatotoxin microcystin. From previous chemostat experiments, it has been observed that *M. aeruginosa* PCC7806SL produces more toxin at colder temperatures, while *M. aeruginosa* NIES-88 produces more toxin under phosphorus-limited conditions. In this study, we annotated sRNAs, examining their gene expression under cold temperature stress, and phosphorous limitation, in *M. aeruginosa*, PCC7806SL and NIES-88, respectively. To identify sRNAs, we employed two distinct approaches. Firstly, we conducted comprehensive literature searches for known sRNAs in other cyanobacteria and aligned the sequences to the genomes of *M. aeruginosa*. Secondly, the Rfam library in conjunction with Infernal software was used to identify sRNAs in the genomes. By integrating these approaches, we identified 15 sRNAs that overlapped between the strains, while 4 sRNAs were found exclusively in PCC7806SL. Two non-coding cis-regulatory elements were also found in both strains. With the annotated sRNAs, we performed RNA-seq differential expression analysis on PCC7806SL and its non-toxic mutant, *ΔmcyB*, comparing sRNA expression under optimal growth temperature 26°C, versus cold temperature growth 19°C. Additionally, RNA-seq differential expression analysis was performed on NIES-88, looking at sRNA expression under varying phosphorous-limiting conditions. Four sRNAs were differentially expressed in PCC7806SL and *ΔmcyB* under cold temperature stress, while five sRNAs were differentially expressed in NIES-88 during extreme phosphorous limitation. Our results suggest that these differentially expressed sRNAs may be regulated by temperature or phosphorous availability in these two strains.

P86 - Investigating the Effect of Human Disturbance on Eastern Bluebirds

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Urbanization has been shown to negatively affect reproduction in a wide variety of wildlife species. More specifically, anthropogenic noise and human activity have been shown to affect nest site selection and reproductive success in songbirds. Here, we used a nest box trail at a large urban green space to investigate the effect of anthropogenic noise and human activity on the nest box occupancy rate and reproduction of Eastern Bluebirds (*Sialia sialis*). The Milliken Arboretum is surrounded by three major roadways with multiple walking trails making it an ideal site for our study. We collected sound measurements and measured the distance from each nest box to the nearest human walkway and roadway. Reproductive success and reproductive output data were compiled from the 2022-2023 breeding seasons. We predicted that increased sound pollution and proximity to human activity would decrease nest box occupancy rate, reproductive output, and reproductive success. We found that distance to the roadway and sound levels did not significantly affect the occupancy rate, clutch size, or fledge rate at our study site. However, the distance to the walkway significantly affected the occupancy and fledge rates.

P87 - Assessing Fish Condition in Lawson's Fork Creek Watershed: Does Urbanization Impact the Condition of Three Fishes?

William Edwards

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This study examined the impact of urbanization on fish condition for three freshwater fishes (bluehead chub *Nocomis leptocephalus*, redbreast sunfish *Lepomis auratus*, and greenhead shiner *Notropis chlorocephalus*) inhabiting the rapidly urbanizing Lawson's Fork Creek watershed located in Spartanburg County, South Carolina. Twelve sites were sampled and 1,505 fish were collected during this study. Fish condition was analyzed using two biological condition metrics: Fulton's condition factor and length-weight residuals. Reach-scale habitat measures and landscape-scale land use measures were recorded to determine relationships of urbanization on stream quality and fish condition. Urban land percentage of the drainage basin above each reach was categorized into levels of low, moderate, and high. Fish condition was also categorized using standard deviation from the mean into good, poor, and normal. Significant differences were found between the categorical variables of urban area and condition for redbreast sunfish ($X^2 = 10.87$, df = 4, $P = 0.028$) and greenhead shiners ($X^2 = 13.47$, df = 2, $P = 0.001$), but not for Bluehead Chub ($X^2 = 7.7212$, df = 4, $P = 0.1023$). The highest percentage of fish in good condition were found at sites with low urban levels for redbreast sunfish (17%) and greenhead shiner (15%). Reduced fish condition in the Lawson's Fork Creek watershed may reflect chronic stress on individuals, which can manifest in decreased reproduction, growth, and survival within a population.

P88 - Deer Herbivory and Woody Vegetation Effects on Smooth Coneflower (Echinacea laevigata) Growth, Size, and Population

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Conservation management of rare habitats is important because theses habitats support small populations of rare species. Smooth Coneflower (Echinacea laevigata) is a federally listed threatened species that inhabits rare forest openings and glades. Woody encroachment and deer herbivory are two threats that this rare species faces. We measured Smooth Coneflower populations in 2 sites in Southwest Virginia over 9 years. In this study we tested how the removal of woody vegetation and implementation of deer exclosures will impact Smooth Coneflower population dynamics. We measured plants size and the population each year at both sites. We found that the population sizes did not change but both plant size and growth rate increased after treatments. These results suggest that woody encouragement and white-tailed deer herbivory may be contributing to the rarity of smooth coneflower. This work supports other research that demonstrates that over-abundant white-tailed deer have significant impacts on forest plant communities and diversity.

P89 - Interbasin transfer of *Etheostoma longimanum* into the Roanoke River drainage

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Invasive species are an ever-growing concern across the streams of North America. Interbasin water transfer projects are solutions to fix water distribution and supply problems and can affect population persistence and patterns of biodiversity in the riverine network. A great deal of attention is given to introductions of species from other continents, while the transfer of North American fishes across drainages is often perceived as less troublesome. An interbasin water transfer project was constructed in Botetourt County, Virginia that directs water from Catawba Creek, a part of the James River drainage, into Carvins Cove reservoir, a part of the Roanoke River drainage. *Etheostoma longimanum,* the Longfin Darter, (Actinoptergyii: Percidae) is native to Catawba Creek, and was suspected to have expanded its range into Carvins Cove reservoir through this interbasin transfer. To determine how far *E. longimanum* has expanded outside of its native range we used a seine and performed survey techniques in multiple first and second order tributaries of Carvins Cove reservoir. We detected *E. longimanum* in only one of the six sites sampled. The site where *E. longimanum* was found is in the tributary where water is transferred from Catawba Creek into Carvins Cove. This suggests *E. longimanum* was able to navigate through the interbasin transfer tunnel but is unable to traverse across the reservoir and colonize additional tributaries. The inhospitable habitat of the reservoir acts a barrier and has prevented *E. longimanum* from invading more of the Roanoke River drainage. If *E. longimanum*

reaches the mainstem of the Roanoke River, it may have negative intraspecific interactions with *Etheostoma podostemone,* the Riverweed Darter.

P90 - Horseshoe Crab Spawning on Cumberland Island National Seashore, Georgia

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Due to habitat loss, urban sprawl, and overexploitation, the Atlantic Horseshoe crab, (*Limulus polyphemus*) has had significant population declines across its range. Horseshoe crabs are considered a "keystone" species of importance to coastal estuarine areas due to their importance as a food source for a myriad of aquatic, shore, and near shore organisms. Therefore, any information regarding the current status, distribution, density, and impacts that may affect this species is critically important to the long-term viability of this species populations. An unstudied population of Horseshoe crabs exists on Cumberland Island, Georgia. The purpose of this study was to document horseshoe crab spawning activity on Cumberland Island in order to form a baseline database for use in crab management and for comparison of effects of future human impacts on this population. Data will be presented from spawning surveys in 2021 (the first survey of its kind on Cumberland Island), 2022, and 2023. Great differences were seen in the spawning over these 3 years, ranging from over 1,000 individuals to just 10.

P91 - Epiphytic diatom production on the seagrass (Thalassia testudinum) in northern Gulf of Mexico

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Seagrass provides coastal protection, habitat and food resources for many economically important marine organisms (e.g. fish larvae), and sequesters considerable carbon (i.e. a "blue
carbon" system)[1]. Seagrass epiphytes (e.g. microalgae, vascular plants) provide food for marine organisms. Some epiphytes, e.g. diatoms, play a role in system carbon cycling. For example, in Ruppia maritima and Halodule wrightii seagrass beds in the northern Gulf of Mexico, seagrassassociated diatoms were shown to contribute 70-80% of benthic net community production (NCP)[2]. For other regionally-important seagrass species, e.g. Thalassia testudinum, there are no data reporting the epiphytic diatom contribution to NCP. Building on these earlier studies, we aimed to answer the question: what is the importance of epiphytic diatoms to Thalassia testudinum NCP? During the summer 2023, seagrass was collected from Pensacola,
Florida (United States) and transported to Dauphin Island Sea Lab (160 km away) where experiments were run in an outdoor mesocosm2. Germanium (Ge) was used as a diatom-specific
inhibitor to quantify the NCP and compare it to unamended (no Ge) controls, thus allowing us to quantify the difference in contribution to NCP due to diatoms[2]. During three experiments over four weeks, NCP decreased with time, potentially due to increasing nutrient limitation. The epiphytic diatom contribution was resolved in one experiment (which had the highest ammonium
concentrations) to be ~20%. Our results demonstrate that, at times, epiphytic diatoms can be significant for Thalassia testudinum NCP, although this contribution was not as high as reported in previous studies for other seagrass species. Also, the rapid shift in epiphyte assemblage productivity (diatoms as significant producers toward insignificance over 4 weeks) may affect the
local seagrass food webs, specifically grazers which rely on epiphytes for nutrition.

P92 - Host regulation controls the colonization efficiency of *Trichoderma harzianum* that induces iron deficiency tolerance in garden pea (*Pisum sativum ssp. hortense*)

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Iron (Fe) deficiency anemia is a health concern due to insufficient dietary intake of Fe in humans, especially in pregnant women and children. While most people rely on plant-based foods as their primary source of Fe, Fe-deficient soil may further reduce the Fe levels in the edible crops. Considering that traditional fertilizers are costly and environmentally unsafe, beneficial microbiomes may offer a sustainable way to improve Fe biofortification. Keeping this in mind, we initially cultivated five genotypes of garden pea (Pisum sativum ssp. hortense) in Fe-deficient soil supplemented with Trichoderma harzianum (a beneficial fungus) inocula to investigate whether T. harzianum can alleviate Fe deficiency symptoms in garden pea and whether its colonization efficiency is host-dependent. We observed distinct variations in chlorophyll scores, plant biomass, and root nodule numbers depending on the sensitivity and tolerance of different genotypes of garden peas exposed to Fe deficiency. Among the sensitive genotypes, Sugar Snap exhibited a significant decline in these morpho-physiological features under Fe deficiency. However, the addition of T. harzianum inocula in the soil substantially improved the health of Sugar Snap, consistent with the higher colonization efficiency of T. harzianum, as evidenced by the higher relative abundance of the ThAOX gene in the roots. It implies that the mycorrhizal symbiosis underlying Fe deficiency tolerance in garden pea is genetically determined. We also observed that the efficiency of T. harzianum in colonizing garden peas varies and is correlated with the number of nodule formations. These preliminary studies warrant extensive research into the mechanistic roles of genes, metabolites, and helper microbes, including Rhizobia that may promote strategies to enhance Fe content in the edible pods of garden peas through microbiome-mediated symbiosis.

P93 - Comparing Sea Turtle Presence and Bycatch Events across Pre-Nesting and Nesting Seasons in Panama City, Florida

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Emphasizing sea turtle conservation efforts is imperative, as nearly all species of sea turtles are listed as either federally or critically endangered. Threats to sea turtle population rates include bycatch, pollution, climate change, and slaughter for turtle shell trade. In the Florida Panhandle, sea turtle bycatch from local fishing piers has been an increasing issue. The purpose of this study was to examine the rates of sea turtle bycatch at a local pier and examine how those rates are affected by seasonal shifts and angler turnout. Data collection took place at Russell-Fields City Pier in Panama City Beach, FL. Between March and October 2023 we measured the presence of sea turtles near the pier and any potential bycatch events throughout the spring (pre-nesting) and summer (nesting) season. We also measured angler metrics, such as number of anglers at a given time and number of lines in the water. Environmental factors such as weather and air/water temperature were recorded for each data collection session. We hypothesized that we would see higher numbers of sea turtles around the pier during nesting season and more anglers on the piers during peak tourist season. Subsequently, we expected bycatch rates to be highest between May and August, where turtles and anglers overlap. Furthermore, we anticipated that weekends and pleasant weather days would have higher bycatch rates due to angler turnout.

P94 - Analysis of Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) venom for anti-cancer activity in human breast cancer cell lines

Dr. Lyndsay V. Rhodes, PhD

Florida Gulf Coast University, Fort Myers, FL

More than 3.8 million women are currently living with breast cancer in the US. While treatments have advanced and people are living longer with this disease, breast cancer remains a devastating illness in need of more effective therapies. Snake venoms are a complex mixture of proteins and enzymes and have been used medicinally in a variety of cultures. Eastern Diamondback Rattlesnakes (EDR) are associated with fear, yet they may contain a wealth of potential anti-cancer compounds in their venom. The overarching purpose of the proposed work is to identify lead compounds that may be further developed into targeted cancer therapies. The goals of this project are to 1) determine if Eastern Diamondback rattlesnake venom is effective against breast cancer cells, 2) identify specific protein components of the venom, and 3) identify which specific components provide the anti-cancer activity. We have screened venom samples from EDR from the southwest Florida region in cell viability assays in triple-negative breast cancer. Additionally, venoms have been analyzed for components to identify potential active proteins. This collaborative project brings together wildlife biologists and cancer biologists to tackle an ongoing, critical public health concern, while also highlighting the importance of wildlife conservation.

P95 - The Health, Parasite Abundance, and Associated Shell Strength in Eastern Oysters (*Crassostrea virginica*) from the Georgia Coast

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Eastern oysters (*Crassostrea virginica*) play a vital role in coastal ecosystems by creating oyster reefs and as a food source for animals and humans. Rural and urban waterways exhibit different physical and chemical parameters, which can impact the organisms that live there. Some invertebrates, such as the polychaete *Polydora websteri,* burrow into oyster shells causing mud blisters that fill with mud and feces. This can weaken oyster shells and make them inedible if the blisters are pierced while shucking. The blisters irritate the oyster, which proceeds to cover the boring worm. To examine the impacts of urbanization on oysters, we examined overall oyster health, *Polydora* infections, and shell crush force. Oyster samples were collected from urban (Brunswick) and natural (Sapelo Island) locations on the Georgia coast in the summer of 2023. Oyster health was assessed using a condition index (CI), which measures the ratio of tissue to shells size. Shells were examined for *Polydora* infections and assigned a score based on the level of infection. Shells were crushed to assess correlations between parasite load and shell strength. There was no significant interaction between CI, parasite infections, or crush force, with a weak positive correlation between parasite infections and crush force. The CI between Brunswick and Sapelo Island did not differ significantly ($p = 0.67$), nor did crush force differ significantly between the two locations ($p = 0.70$). We observed a significant difference in parasite infections between Brunswick and Sapelo Island ($p = 2.97e\text{-}13$), with higher numbers of infections on Sapelo Island, showing that natural sites in our study tended to have more parasite exposure than urban areas. This suggests that factors associated with urbanization may be responsible for the lower parasite exposure we observed along the Georgia coast. Further research will help to elucidate the potential cause of these differences.

P96 - Identification of Anti-Metastatic Compounds in Triple-Negative Breast Cancer

Gavriel Burger, Dr. Lyndsay V. Rhodes, PhD

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Triple-negative breast cancer (TNCB) is an aggressive subtype of breast cancer that is known for its high metastatic, recurrence, and mortality rates. TNBC disproportionately affects minority women and women under 40 years of age. Prognosis is poor due to ineffective treatment options and the ability for the cancer to develop drug resistance. Therefore, new therapeutics are needed to increase treatment optimization and survival for TNBC patients. In this study, resveratrol—a stilbene compound derived from plants—and several of its analogues, were tested to determine anti-cancer and anti-metastasis capabilities. This study tests the hypothesis that the effectiveness of

the stilbene drugs in TNBC is mediated through the reversal of the epithelial-to-mesenchymal transition (EMT), a key pathway regulating metastasis in TNCB. The proposed effectiveness of the stilbene drugs has been tested through migration and invasion assays, which both show significant changes in TNCB cells metastatic behavior in response to treatment with the compounds. Confirmation of the reversal of EMT was tested through gene expression studies, looking at both early onset and later onset transcription factors known to contribute to EMT. Taken together, these data indicate that resveratrol and/or its analogues may be viable lead targets for further development as anti-metastatic compounds for the treatment of TNBC.

P97 - Enhancing Antimicrobial Efficacy and Biofilm Inhibition Using MXene Nanomaterial-Based Coatings on Medical Devices

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Fungal infections present significant challenges to human health, and the development of highly effective, biocompatible antimicrobial agents is an urgent problem to be solved. However, the rise of drug-resistant fungi and antibiofilm development have shown limited efficacy, highlighting the need for novel solutions. Recent studies show the antimicrobial potential of two-dimensional (nano)structured MXene-based composites (Ti_3C_2Tx), which may possess the ability to damage bacterial membranes and generate oxidative stress. With rapidly growing resistance to current medications, bacteria like *Candida albicans* require this method of early cell targeting before irreversible biofilm attachment. This study examines the short-term biofilm inhibition of *C. albicans* on modified surface materials through coatings of MXene. Both BioMed Clear Resin and TPU material coupons are sprayed with a layer of MXene coating. *C. albicans* are incubated with the MXene-sprayed samples in RPMI media to measure the cell adhesion by a colony counting assay after 6 and 24 hours. Viability is analyzed through a Trypan Blue live/dead assay and reactive oxygen species (ROS) assay, using 2',7'-dichlorofluorescin diacetate (DCFH-DA) with microscopy images. The results show that modified-surface coupon samples inhibit *C. albicans* growth and biofilm formation by limiting initial adherence. This finding suggests MXene-coating on 3D materials as a potential avenue to address fungal biofilm formation and drug resistance, paving the way for innovative antimicrobial agents in medical devices such as dental implants or prosthetics.

P98 - Effects of *Streptococcus salivarius* M18 probiotic supplement on the human oral microbiome

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The oral microbiome has a direct correlation to heart health, and the rest of the body. Gum and tooth health starts with a healthy microbiome consisting primarily of beneficial bacteria. If a person's oral microbiome is not healthy, supplementation with probiotics may be helpful toprevent future oral problems. Our project goal is to determine whether commercial oral probiotic supplements affect the composition of the oral microbiome. To start, we first selected the BLIS M18 oral probiotic lozenge containing the M18 strain of Streptococcus salivarius (M18), which produces an antibiotic called bacteriocin. To determine whether we could grow the M18 probiotic from the lozenge in our laboratory, we optimized growth conditions using common bacterial growth mediums and isolated colonies to characterize based on Gram status, and growth on selective/differential media. After completing our preliminary studies, we also obtained IRB approval to conduct a study with Catawba College students given the BLIS M18 lozenge for two weeks. A control group was given a placebo lozenge (no probiotic) for comparison. We collected buccal swabs from each study participant at the start of the study and again after two weeks of oral probiotic/placebo use. We will use Next-Generation Sequencing to determine changes in the microbiome between the groups given the placebo or M18 probiotic. We hope to find that M18 supports the healthy growth of beneficial oral bacteria, which may prevent or suppress the growth of harmful, disease-causing bacteria.

P99 - Predicting ovarian cancer using comorbidities and demographics as risk factors

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Introduction:

Ovarian cancer is the most lethal gynecological malignancy and although many potential risk factors have been identified, delayed diagnosis and late-stage detection is common. Early detection is a critical aspect of patient survival, and understanding risk factors can increase early detection. By identifying associations between ovarian cancer and various risk factors, this study aims to improve ovarian cancer management and patient outcomes.

Methods:

Administrative data analysis was performed on Florida state inpatient data (SID) collected in 2012 by the Healthcare Cost and Utilization Project (HCUP). Demographic variables included age, race, insurance, and income. Comorbidities included diabetes, hysterectomy, hypothyroidism, and depression. For each independent variable, descriptive and logistic regression analyses were performed using SPSS and confirmed with SAS in order to determine frequencies within binary ovarian cancer outcomes and to calculate associations.

Results:

Our results demonstrated that ovarian cancer was most frequent in white women (73.47%) over 65 (50.17%), who were Medicare beneficiaries (57.00%), within the second quartile of annual income ($38,000-$48,000) (30.71%). Logistic regression analysis

demonstrated higher risk of ovarian cancer in women over 65 compared to younger women (OR= 4.277; 95% CI= 3.585-5.103). Privately insured women had increased odds compared to women with Medicare (OR= 1.426; 95% CI= 1.245-1.634). The risk of ovarian cancer was higher in women with diabetes (OR= 1.134; 95% CI= 0.973-1.331), women who had a hysterectomy (OR= 18.543; 95% CI= 15.262-22.530), and women with hypothyroidism (OR= 1.083; 95% CI= 1.021-1.148) in comparison to women without these conditions.

Conclusions:

This study identifies several comorbidities and demographic variables as ovarian cancer risk factors. The inclusion of both comorbidities and demographics in patient risk assessments can help increase early detection, improving management of ovarian cancer and ultimately benefiting women's health.

P100 - Analysis of Fluorescent Microscopy Images to Better Understand Keratin's Effect on Protein Recycling Pathways in Human Embryonic Kidney Cells

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Molecular recycling pathways are used by cells to mitigate stress and/or damage. Autophagy is a process in which cells degrade and recycle unneeded or damaged components to ensure cell survival. The ubiquitin-proteasome system (UPS) is another recycling pathway specific to protein removal. These processes allow cells to operate more efficiently both in regular maintenance and during times of stress. Our lab has preliminary data to suggest that keratin biomaterials may interact with one or both pathways. However, these studies are not definitive because the transfection system used to track autophagy activation and UPS activation results in images that are not easy to interpret, and validation/reproduction of these data has not occurred. To this end, this research was aimed at re-processing images from keratin-transfection studies to 1) validate/reproduce results observed in prior studies and 2) to test the hypothesis that previously un-counted data (the number of autophagy/UPS aggregates per cell) might be a better indicator of pathway activation than the previous method of counting (percent cells with autophagy/UPS aggregates vs those without).

P101 - Elucidating determinants at the Gα13 N-terminus for binding to the βγ dimer.

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Heterotrimeric guanine nucleotide-binding proteins (G proteins) are cell signaling conduits composed of the subunits α, β, and γ. These proteins relay signals from cell surface receptors to various downstream effector proteins. The α subunits Gα12 and Gα13 are implicated in multiple tumor types as wildtype (WT) and constitutively active (QL) forms. Gα13 is overexpressed in multiple tumor types including invasive breast cancer, prostate adenocarcinoma, and ovarian cystadenocarcinoma. It is crucial to identify potential therapeutic sites in Gα13, and considerable work has examined its mechanism of binding to downstream effectors as well as its post-translational modifications. No studies have precisely defined the amino acids of Gα13 required for binding the βγ dimer, nor whether initial association with βγ is necessary for lipid modifications of Gα13. We have sought to identify amino acids in Gα13 required for binding to the β subunit, and also determine whether association with βγ is necessary for signaling by Gα13WT compared to the QL form. Therefore, we mutated amino acids in Gα13 previously suggested as N-terminal contact points with the β subunit. Also, recent work by Wedegaertner and colleagues identified a single amino acid within a different G subunit, Gαq, that is crucial for its binding to β (Aumiller and Wedegaertner, 2023, J. Biol. Chem. 299:102880). Based on Gαq and Gα13 alignment, we also engineered a single amino acid mutation in Gα13 WT and QL. All mutants were expressed in HEK293 cells, and lysates were used in a glutathione-S-transferase pulldown assay. Precipitates were subjected to immunoblotting to determine the presence of Gα13 variants in the sepharose-bound β subunit samples. Preliminary results suggest these mutations disrupt both Gα13 WT and QL binding to the β subunit. Currently we are examining these mutants for tumorigenic growth signaling and ability to interact with other known binding partners of Gα13.

P102 - Characterizing Neprilysin's Regulation of the PI3K Pathway in Triple Negative Breast Cancer

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Triple-negative breast cancer (TNBC) comprises 15-20% of all breast cancer cases. TNBC lacks the expression of estrogen, progesterone, and HER2 receptors. This increases the difficulty of receptor-targeted therapy, making it an aggressive form of breast cancer with a poor prognosis and increased recurrence rate. Neprilysin (NEP) is a cell surface enzyme associated with vasoregulation and some cancers that cleaves extracellular peptides to deactivate them. Our lab and others have found that NEP is differently expressed in breast cancers and negatively regulates breast cancer invasion. In this study, we questioned what proteins and signaling pathways are associated with NEP expression in TNBC. Through bioinformatics, we found a significant association between NEP mRNA expression and proteins associated with the phosphoinositide 3-kinase (PI3K) pathway, the most commonly mutated pathway in TNBCs.

Because of NEP's role in inactivating peptides known to activate the PI3K pathway and its previously described role as an inhibitor of cancer invasion, we initially hypothesized that NEP would negatively regulate PI3K signaling in TNBC. However, our data revealed that in multiple TNBC cell lines, NEP positively regulates Akt, the key mediator of PI3K signaling. We investigated a potential mechanism for this unexpected regulation of PI3K by NEP using Western blots and RT-PCR analysis of TNBC cell lines and found associations between NEP and both casein kinase 2 (CK2) expression and phosphate and tensin homolog (PTEN), the primary negative regulator of PI3K signaling, suggesting one or both proteins may be involved in NEP regulation of PI3K signaling. Furthermore, we

analyzed The Cancer Genome Atlas (TCGA) datasets and found that NEP, CK2, and PTEN gene and protein expression profiles predict clinical outcomes of TNBC patients. Ongoing experiments in our lab are seeking to further define the mechanism and functional significance of NEP regulating PI3K in triple negative breast cancer.

P103 - Invertebrate substitutions of a conserved region in Gα13 reveal determinants of SRF signaling and RhoGEF binding

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Gα12 and Gα13 are alpha subunits of heterotrimeric guanine nucleotide-binding proteins, and drive signal transduction pathways responsible for cellular growth, cytoskeletal alterations, and oncogenic development. Both proteins bind and activate a specific group of Rho-directed guanine nucleotide exchange factors (RhoGEFs) in order to stimulate several cellular responses, but the structural features that are distinct between Gα12 and Gα13 in this mechanism are not known. Invertebrates possess a single homolog of mammalian Gα12/Gα13, which retains the ability to trigger cytoskeletal rearrangements but is incapable of signaling to SRF (serum response factor), a transcriptional activator that plays a role in Gα12- and Gα13-mediated tumor progression. Previous research in our lab revealed a highly-conserved 36-amino acid region that contained only 10 (for Gα12) and 9 (for Gα13) divergent residues when compared to the *Caenorhabditis elegans* homolog. Although invertebrate substitution of this region eliminated SRF signaling for both Gα12 and Gα13, disruption of RhoGEF binding was observed only for the Gα13 mutant. To understand the Gα13-specific structural determinants of this interaction, we bisected its 36-residue region and found the N-terminal invertebrate substitutions were crucial to abolishing RhoGEF binding and SRF signaling. However, single-point mutations in this region were inconsequential, leading to our current strategy of constructing multi-point invertebrate substitutions to subdivide the Gα13 N-terminal region and identify its critical residues for SRF signaling and RhoGEF interaction. We have identified two mutants of Gα13, each containing three invertebrate substitutions, that show a dramatic loss of SRF signaling. Currently, co-precipitation assays using immobilized RhoGEF domains are being conducted to observe the impact of these mutations on binding to RhoGEFs and other known Gα13 target proteins.

P104 - Discovering Gelatin's Effect on Cellular Growth and Autophagy in Human Embryonic Kidney Cells

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Autophagy is a cellular self-degradation process. Generally, it is triggered when the cell is not receiving adequate nutrients, however it can also be triggered as a response to stress of the cell such as starvation and heat shock. Gelatin biomaterials are known to promote cell attachment, which might mitigate stress in cells. My goal was to determine the level of effect (if any) gelatin's presence has on viability and autophagy activation in human embryonic kidney (HEK) cells. I tracked viability with live/dead and MTT assays and am utilizing western blotting to assess autophagy activation through determination of whether the autophagy protein, LC3, changes with gelatin exposure. Thus far, my experimentation shows that gelatin does not lead to major changes in cell viability- although the results appear to be somewhat variable. Western blotting studies are activity underway. This study helps to shed light on how or if autophagy can be altered when in contact with different biomaterials. Ultimately, this research will be used as a comparison to the effects that keratin, a similarly structured biomaterial, has on autophagy.

P105 - Introducing Immunofluorescence Microscopy of Tetrahymena in Cell Biology Lab

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Immunofluorescence (IF) microscopy is an essential laboratory technique within the field of biological sciences. This technique offers high sensitivity to observe biological samples so that scientists can visualize cellular and sub-cellular structures that may be too difficult to be observed with a traditional light microscope. It works by two main procedures, IF staining which tags the sample with a single antibody linked to a fluorophore, and IF microscopy which illuminates the sample with blue or UV light. Mastering this technique enables students to gain a greater understanding of biological systems by further enhancing optical resolution. The primary goals of this project are to (1) introduce a dedicated module on IF microscopy to students enrolled in the Cell Biology lab course, (2) aid students in gaining a basic understanding of the principle of IF staining and IF microscopy by allowing hands-on experience in labeling and imaging biological samples, and (3) emphasize the importance of this technique to students' future science career and to encourage students with the confidence to navigate and excel in advanced laboratory settings. This is a project that has been implemented since Fall 2023 and will continue for at least two or more semesters. We plan to present the outcomes of this project including (1) the laboratory procedure on IF microscopy and student handouts for the UNG cell biology course, (2) student assessments to test students' pre-existing knowledge in addition to the understanding and application of IF microscopy after completion of the lab module.

P106 - Descriptive Analysis of Anthozoan Nervous System Using Fluorescence Microscopy

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The cnidarian nervous system is one of the earliest to evolve in the metazoa. Although the simple nerve net has been visualized in non-

symbiotic anemone species, there is very little information on the nervous organization in symbiotic species. In this study, we will utilize fluorescence microscopy to tag neuropeptides and allow visualization of the nervous system in an aposymbiotic anemone model, Exaiptasia pallida. Basal metazoan analyses contribute to our understanding of of more complex nervous systems in animals.

P107 - RNAseq reveals evidence for phosphate-dependent control of symbiont cell division in the model anemone *Exaiptasia diaphana*

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Reef-building corals depend on symbiosis with photosynthetic algae that reside within their cells. As important as this relationship is for maintaining healthy reefs, it is strikingly delicate. When ocean temperatures exceed the average summer maximum for a few days, corals can bleach, expelling their endosymbionts. While the mechanisms governing bleaching are unknown, studies implicate uncoupling of coral and algal cell divisions at high temperatures. Still, little is known regarding the coordination of host and algal cell divisions that is crucial in maintaining a healthy symbiont density. Control of nutrient exchange is one likely mechanism. Both nitrogen and phosphate are necessary for dividing cells, and while nitrogen enrichment is known to increase symbiont density in the host, the consequences of phosphate enrichment are not well-understood. In this study, we examined the effects of phosphate depletion on symbiont growth in culture and compared the physiology of phosphate-starved symbionts in culture to symbionts that were freshly isolated from a host. RNAseq revealed that phosphate-limited and freshly isolated symbionts have similar patterns of gene expression for phosphate-dependent genes, most notably upregulation of phosphatases, which is consistent with phosphate recycling. Similarly, lipid profiling revealed a substantial decrease in phospholipid abundance in both phosphate-starved cultures and freshly isolated symbionts. These findings are important because they suggest that limited exchange of phosphate is a pre-mitotic mechanism used by hosts to control algal cell divisions.

P108 - PAR-1 Activation Interferes with Normal Axon Development in *C. elegans* Through the Rho-kinase and PLC Pathways

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Thrombin, a key coagulant, influences cells both inside and outside the vascular system by activating protease-activated receptor-1 (PAR-1), a G-protein coupled receptor found on many cells including motoneurons. Studies show that neuronal PAR-1 activation impacts cell survival and axon formation through activation of its downstream effectors Phospholipase C (PLC) and Rho-kinase. While the PLC pathway is responsible for axon depolymerization, the Rho-kinase pathway regulates overall axon growth. Therefore, understanding thrombin is crucial, as vascular damage following injury leads to thrombin accumulation in the nervous system and the subsequent activation of these pathways. In *Caenorhabditis elegans*, embryonic exposure to thrombin causes axon deformities, but its specific mechanism is unclear. This study aims to clarify PLC and Rho-kinase signaling in thrombin-mediated axon development in *C. elegans*. If either pathway is involved in thrombin-mediated axon development, then inhibiting both should prevent the creation of axon deformities. To examine axon formation, *C. elegans* eggs were exposed to one of six conditions: control, PAR-1 activation (100 mM thrombin), Rho-kinase inhibition (250 mM Y27632), PLC inhibition (100 mM U73122), Rho-kinase inhibition + PLC inhibition, and PAR-1 activation + Rho-kinase inhibition + PLC inhibition. A Kruskal-Wallis rank sum test and Wilcoxon post-hoc test (95% CI) showed a significant difference in the percentage of axon deformities between all the groups. Overall, the PAR-1 activated group co-treated with Rho-kinase and PLC inhibitors had the most axonal deformities compared to other groups, demonstrating that thrombin binding to PAR-1 activates both pathways resulting in abnormal axons. Understanding how the pathways initiated upon PAR-1 activation interact and relate to each other gives insight into how thrombin interferes with axon growth following injury.

P109 - Understanding the Overexpression of TAF2 and TAF13 in Eukaryotic cells

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TATA-binding protein (TBP) and TATA box-binding protein-associated factors (TAFs) comprise RNA Polymerase II (RNA Pol II) pre-initiation complex, a universal component that carefully controls the transcriptional initiation process. Two of the TAFs, TAF2 and TAF13, also play an important role in the regulation of RNA Pol II transcription initiation which is evolutionarily conserved from yeast to humans. It is found that TAF13 is overexpressed in thyroid carcinoma (TC) cells, while TAF2 is overexpressed in both hepatocellular (HCC) and ovarian carcinoma (HGSC) cells. The exact mechanism that is responsible for these overexpressions is unclear. Our hypothesis suggests that targeted degradation by the 26S proteasome via ubiquitylation (UPS) may be the mechanism that regulates the stability of both TAF2 and TAF13. To test this possibility, we evaluated the role of UPS on the stability of both proteins in yeast (Saccharomyces cerevisiae). Importantly for the first time, we found that both TAF2 and TAF13 undergo polyubiquitylation and have yet to find if it is regulated by the 26S proteasome. In the case of our hypothesis being supported by experimental results, therapeutic intervention could be possible for future patients.

P110 - The Cryptic Creatures: Determining Habitat Occupancy of Pine Snakes (Pituophis melanoleucus) using environmental DNA

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The Pine Snake (*Pituophis melanoleucus*), is listed in the South Carolina Wildlife Action Plan as a "species of greatest conservation need" but little is known about their current abundance and distribution within SC due to their low population density and secretive lifestyle. Commonly used presence/ absence survey methods such as drift-fence trap arrays may fail to reliably detect Pine Snakes even when they are present in a given habitat. We developed novel primers to detect Pine Snakes using environmental DNA (eDNA) in an effort to increase the efficacy of detecting these snakes in critical habitats. eDNA is becoming increasingly used to aid traditional ecological survey techniques for identification of rare and endangered species. *Pituophis*-specific primer pairs targeting the *NADH dehydrogenase subunit 4* (ND4) gene were developed and assayed for specificity and sensitivity in laboratory and environmental application. Specificity tests confirmed selective amplification of *Pituophis* versus conspecifics using skin and tissue samples. Sensitivity assays resulted in a Limit of Detection threshold of 25 ng of tissue or skin DNA. eDNA samples were collected from three ~200-hectare sectors within a study site on the South Carolina Coastal Plain containing a known Pine Snake population, to test the effectiveness of primers in detecting Pine Snake presence and distribution. Our results may enhance Pine Snake conservation planning by providing an efficient, non-invasive tool to assist in detecting presence of Pine Snake populations statewide.

P111 - Assessing proteins interactions of a potential chloroplast spliceosome

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Chloroplast group IIA intron excision is postulated to involve up to 21 different nuclear-encoded proteins. Several studies, however, indicated that a plastid-encoded protein factor, specifically the MatK maturase, is the main splicing factor for chloroplast group IIA intron excision. As such, it is unclear which proteins are truly required for facilitating chloroplast group IIA intron excision. We propose that nuclear-encoded proteins form a splicing complex along with the MatK maturase to efficiently facilitate chloroplast group IIA intron excision. Co-immunoprecipitation assays were employed to test interactions among postulated nuclear-encoded splicing factors and the MatK maturase. Initial findings from co-IPs indicated possible interactions of MatK with the nuclear-encoded proteins RNC1, WTF1, RH3, RH25, RH53, and RH32. Clones of these nuclear-encoded proteins were generated for further interaction assays with the MatK maturase using a bacterial two-hybrid system.

P112 - Subcloning and Fusion of a Crystallization Protein Gene from a pBN1Aa Vector to a Green Fluorescent gene Within a pEVOL Vector in *E. coli* DH5α

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The Cry proteins, which originate from Bacillus thuringiensis, have insecticidal properties and, therefore, are widely used in agriculture. The goal of this project was to subclone the Cry1Aa gene, held in a modified pBN plasmid, and fuse it with a green fluorescent protein (GFP) gene contained in a pEVOL vector. Molecular techniques, including, but not limited to plasmid extraction, restriction enzyme digestion, polymerase chain reaction (PCR), agarose gel electrophoresis, ligation, and transformation were used to achieve the goal. Restriction enzyme digestion and gel electrophoresis of the ligation product indicates that there is plasmid DNA that is the approximate length of pEVOL and the CRY1Aa gene combined, but transformed E. coli DH5α colonies do not appear to fluoresce under a black light. Preliminary results suggest that the Cry1Aa gene was successfully fused into the pEVOL plasmid, but, with no visible expression of the GFP in the transformed colonies, sequencing is required to verify success or failure.

P113 - Comparative effects of all-trans and 4-hydroxy retinoic acid on early *Danio rerio* development

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Vertebrate development relies on a carefully orchestrated sequence of gene expression events, controlled by tightly regulated exposure to both endogenous and exogenous signals. One such signal is all-trans retinoic acid (ATRA), a potent morphogen whose gradient is carefully controlled during vertebrate development. A wealth of data has indicated excess retinoic acid has potent effects on normal development, and its teratogenic effects have been extensively documented in experimental models like *Danio rerio*. Less is known about the effects of other, less potent, retinoid metabolites in influencing vertebrate development. This gap in knowledge is pertinent, as recent reports have indicated that metabolites of ATRA are present in surface water (Pipal et al., 2022), which may have deleterious effects on the development of vertebrates in this environment. In the current study, *Danio rerio* embryos, 3 hpf and undergoing cleavage, were exposed to three different ATRA concentrations over 72 hours: 1 nM, 10 nM and 100 nM. The development of these embryos was compared to that of control and vehicle control treated embryos. Teratogenic effects on axis formation, somitogenesis and heart development were quantified, and survival rates were determined upon embryo hatching. The data indicate a dose-dependent effect of retinoid treatment on *Danio rerio* development.

P114 - America's "Lost" Tea: Using genetics to unravel the evolutionary history and metabolic diversity of yaupon holly

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While plant secondary metabolites have played integral roles in human health, food, and industry for thousands of years, still relatively little is known about the genetic mechanisms that generate their incredible diversity, nor their long-term effects on plant species

colonization and persistence in harsh habitats. Yaupon holly (*Ilex vomitoria*) is a plant native to the coasts of the southeastern US whose leaves are used to brew a caffeine-containing infusion similar to tea. Its unique phytochemistry, wide adaptability, and observed variation in secondary metabolite profiles make it an excellent system to study how the production of plant secondary metabolites is shaped by adaptative evolution, but the underlying evolutionary history of this plant remains unknown, and its secondary chemistry has yet to be fully characterized. To address these gaps, we are constructing a living diversity panel comprised of ~300 live, wild yaupon holly plants self-collected from across the Southeast, each paired with genotyping-by-sequencing data. Using this genotype data, we aim to answer foundational questions about the evolutionary history of yaupon holly and probe the genome for evidence of recent adaptation in secondary metabolic processes. We also present preliminary data on the secondary metabolic composition of yaupon holly generated using LC-MS, both in green leaves and post-tea processing. Upon completion of these objectives, we hope to shed light on the forces that shape plant secondary metabolism at the level of communities and populations, as well as lay a foundation for future research in this organism.

P115 - Unraveling the Microbial Diversity of Ecosystems under the influence of Environmental Pollution

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Escalating pollution levels continue to inflict critical threats to the delicate balance of ecosystems worldwide, including those in South Florida. Investigating the repercussions of pollution on bacterial diversity within these waterways is paramount for devising effective strategies to combat its adverse effects. This study aims to shed light on the impact of pollution on bacterial biodiversity by analyzing environmental DNA (eDNA) extracted from water samples collected from polluted and unpolluted South Florida sites. Using advanced DNeasy PowerWater DNA extraction kits, DNA sequencing, and DNA Metabarcoding via DNA Subway, this research aims to identify distinct bacterial species from various locations and highlight significant differences in bacterial diversity and composition. Although the project and its findings are still ongoing, our current results reveal an overall impressive diversity of bacteria from all samples as a whole, with a total of 4125 DNA fragments identified. This quantity of diversity is significant, as it provides a robust dataset for our ongoing analyses. Further, our research aims to continue identifying specific trends in bacterial abundance and distribution from the separated polluted and unpolluted sites and potentially pinpoint key indicator species that could serve as markers for pollution levels and environmental health. For instance, we have identified a bacteria commonly found in bioremediation processes in previously restored superfund sites. By comprehending the intricate interplay between pollution and bacterial biodiversity, this study hopes to contribute to the development of proactive measures aimed at mitigating the proliferation of harmful contaminants, safeguarding the integrity of South Florida's waterways, and preserving the region's diverse ecosystems.

P116 - Characterizing Biodiversity of Foliar Endophytic Fungi in Sweet Birch (*Betula lenta*) in Western NC.

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Foliar endophytic fungi (FEF) are fungal microorganisms which inhabit the space between plant cells without causing visible signs of disease in the host. FEF have a symbiotic (mutualistic, parasitic or commensalistic) relationship with their host. FEF have a high taxonomic richness and it is thought that a majority of the fungal family is Endophytic fungi that is yet to be described. FEF are found to be symbiotic with all temperate tree species but the exact nature of FEF and their hosts is still poorly understood. The Appalachian mountains offer a rich potential for studying FEF/host dynamics, due to the high biodiversity and geologic history of the region. The nature of FEF biodiversity in the southern Appalachian mountains is not well understood. This may be due in part to the fact that FEF lack distinctive fruiting bodies and can be challenging to identify based on visual characteristics alone. This study will use DNA barcoding to identify 28 unknown FEF morphotypes that were isolated as part of a larger, ongoing project aimed at understanding the relationships between FEF colonization and ecophysiological performance in Sweet Birch (*Betula lenta*, Betulaceae), a tree native to the eastern United States. To our knowledge, this represents the first study to examine FEF communities in the southern Appalachian mountains.

P117 - Genetic Diversity of Passerines in Metro Atlanta

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Counties in metro Atlanta are undergoing rapid development and landscapes are becoming less natural and more urbanized. The resulting habitat destruction is likely disrupting wildlife, including songbirds. We have been surveying passerines in Gwinnett and Rockdale counties from 2018-2023. Feather and blood samples have been used to isolate DNA and to sequence the mitochondrial gene cytochrome c oxidase subunit 1 (coi). Using results of coi sequences, genetic diversity has been measured via calculations of nucleotide diversity, haplotype diversity, numbers of SNPs and numbers of haplotypes. For some species, genetic diversity is higher in areas with less urbanization. Haplotype maps have been made to visualize and compare genetic diversity of species at locations with differing levels of urbanization. Measurements of Tajima's D indicate most populations are evolving neutrally, but in some cases populations are expanding at select locations.

P118 - Changes in Mortality, Heart Rate, and Gene Response in *Daphnia magna* Exposed to Concentrated and Homeopathic *Kalmia latifolia* Distillates

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Kalmia latifolia, the mountain laurel, contains dangerous diterpene grayanotoxins, which make all parts of the plant toxic. Human consumption of honey made from *Kalmia* and *Rhododendron* nectar, so-called 'mad honey,' can result in serious poisoning. Despite this, homeopathic *Kalmia latifolia* tincture is available for purchase online. Here, we test a concentrated *Kalmia latifolia* tincture produced in the laboratory against a commercially available homeopathic *Kalmia latifolia* tincture. To evaluate outcomes, we treat *Daphnia magna* with these tinctures and evaluate changes to mortality, heart rate, and the differential expression of several genes related to detoxification and stress response. We find that the concentrated *Kalmia latifolia* tincture contains cytotoxic compounds beyond the ethanol solvent alone. This is evidenced by lower heart rates in daphnids 24 hours after treatment, and by the upregulation of *Hsp90*, a stress response gene, when compared to other treatment types. However, ethanol alone was found to cause higher mortality at both 24 and 48 hours than either *Kalmia*-based tincture. We believe, despite poor solubility, some level of the hydrophobic grayanotoxins dissolve in the ethanol solvent used to create the distillation and are present in the final concentrated tincture making the final tincture likely far less potent than one performed using a strong organic solvent. Ethanol is a poor solvent for grayanotoxins and the final level of cytotoxins in the concentrated tincture is likely quite low. We find relatively little evidence for acute cytotoxicity in daphnids exposed to a concentrated *Kalmia latifolia* tincture.

P119 - Secrets of the Swamp: Uncovering the genetic diversity of a federally threatened plant species, swamp pink (*Helonias bullata*)

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Helonias bullata L. (swamp pink) is a monotypic plant genus belonging to the Melanthiaceae family. *Helonias* is listed as a federally threatened plant species and is a long-lived perennial evergreen herb that occurs in wetlands and bog subtypes in the eastern United States. While these habitats are already increasingly rare, development and urbanization has fractured and extirpated many *Helonias* occurrences, leading to a mosaic of small, isolated populations throughout its range. Due to the limited number of individuals within many of these populations, *Helonias* faces the perilous threat of genetic diversity loss which can lead to population instability and collapse. This research focuses on developing an in-depth genetic diversity analysis of the extant *Helonias* populations in North Carolina, as well as identifying the occurrence of genetic drift within smaller populations. Currently, there is very limited genetic data available for *Helonias*; only two sites in North Carolina have previously been assessed. Leaf samples from 14 Element Occurrences across the state were collected and DNA extracted using an advanced CTAB approach. MIG-seq, a next-generation sequencing method, will be used for *Helonias* library construction, followed by sequencing and single nucleotide polymorphism (SNP) identification within the genome of each individual sampled. In total, 300 individuals will be genotyped using multiplexed inter-simple sequence repeat (ISSR) genotyping by sequencing. This data will be used to calculate genetic diversity for each population, observed through allelic richness and heterozygosity. This critical genetic analysis will identify populations within North Carolina containing high genetic diversity as well as at-risk populations experiencing genetic drift. This data will, in turn, help inform future management decisions such as genetic rescue implementation and habitat conservation.

P120 - Assessing progression of muscle phenotypes in an adult-onset model of myotonic dystrophy in Drosophila melanogaster

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Myotonic Dystrophy Type One (DM1) is a multisystemic genetic disorder caused by a series of CTG repeats in the dystrophia myotonica protein kinase (DMPK) gene. Unaffected individuals have between 5-37 CTG repeats while individuals diagnosed with DM1 may display CTG expansions ranging from 50-4000 repeats. Individuals with shorter repeat expansions develop symptoms in the later adult years, where individuals with very long expansions can have a juvenile or congenital onset. To determine the advancement of the physiological defects in an adult-onset DM1 model, our lab utilized the the GAL4/UAS system in Drosophila melanogaster (fruit fly) to drive expression of the CUG repeat expansions to mimic DM1. Previous Drosophila models of DM1 have used embryonic drivers to successfully recapitulate the DM1 phenotype. We are using an adult-onset driver, 1151-Gal4, to study the progression of DM1, without the confounding effects of developmental defects that can occur with embryonic onset of repeat expression. 1151-Gal4>UAS-CUGexp flies do not show skeletal muscle defects after one or two weeks of expression, as was observed in Drosophila DM1 models using embryonic drivers. We have tested 1151-Gal4>UAS-CUGexp flies for physiological defects in climbing velocity and flight capability at 3, 4, and 5 weeks of CUGexp expression. A subset of flies of each genotype that have completed testing were prepared for histological analysis to measure the muscle atrophy in the late onset model. Analysis of the data collected is underway to determine the time course for muscle-specific expression of CUG repeat RNA in Drosophila melanogaster. If physiological defects are observed, this model will allow for a simplified model to perform mechanistic studies into DM1 that are unclouded by developmental defects caused by expressing repeats embryonically.

P121 - Pvr Modulation and its Relation to DM1 Muscle Wasting in Drosophila

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Myotonic dystrophy type 1 (DM1) is an inherited multisystem disorder that causes severe muscle wasting. DM1 results from CTG-repeat expansions in the untranslated region of the *dystrophia myotonica protein kinase* (*DMPK*) gene. While the cause of DM1 is known, the underlying mechanism behind DM1 muscle wasting is not fully understood. Previous research using a mouse model of DM1 with severe muscle wasting showed deregulated PDGFRβ signaling. PDGFRβ is a receptor that regulates cell growth, survival, and differentiation. Our lab is evaluating the role of the *Drosophila melanogaster* PDGFRβ ortholog, pvr, in muscle maintenance and the progression of DM1 phenotypes. We are using the Gal4/UAS system in *Drosophila* to knockdown *pvr* expression via RNAi (pvr-RNAi) or to overexpress activated pvr protein (PVR-OE) in the presence and absence of expanded CUG-repeat RNA (CUGexp). These models will allow assessment of the role of pvr signaling in the progression of DM1 phenotypes. We will knockdown or overexpress pvr in both the control (UAS-CUG20) and DM1 fly model (UAS-CUG250) using Mef2-Gal4 to drive skeletal muscle-specific expression of both CUGexp repeats and the modifier. We will measure climbing velocity (mm/second) and flight capability (landing height in cm) to assess muscle function in these flies. Representative samples will be prepared for histological analysis to measure muscle atrophy. RT-qPCR of RNA isolated from the thoraces will allow evaluation of expression levels of *pvr* to test the efficacy of knockdown, as well as Pvr signaling downstream targets *hid*, *dpp*, *thor*, and *myc*. We will analyze levels of activated Pvr protein in all samples via western blot. Matings to generate appropriate genotypes are currently underway. We expect this research will shed light on the requirement of pvr signaling for proper skeletal muscle development and function in flies and in the progression of DM1.

P122 - Combinatorial effects of PUFAs and piscidins on the membrane permeability and antimicrobial activity in *Vibrio parahaemolyticus* and *Vibrio vulnificus*

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Piscidins are fish antimicrobial peptides (AMPs) that are an important part of the innate immune system due to their potent antimicrobial properties. Piscidin 1 (P1) exhibits strong membrane disruptive properties, while piscidin 3 (P3) targets DNA. These piscidins can experience metalation with copper (Cu^{2+}) which enhances their antimicrobial activity *in vitro*. *Vibrio parahaemolyticus* is one of the leading foodborne pathogens in humans, causing acute gastrointestinal and immunological disorders. *Vibrio vulnificus* has high mortality (18%) and economic burden ($320 million/year worldwide), causing necrotizing fasciitis and sepsis leading to approximately 100 deaths per year in the United States. To examine polyunsaturated fatty acid (PUFAs) impacts on piscidin activity, we performed permeability and minimal inhibitory concentration (MIC) assays with linoleic (18:2), arachidonic (20:4) and docosahexaenoic (22:6) acids. In *V. parahaemolyticus*, PUFAS raised the MIC for P1 and P1-Cu^{2+} while the opposite effect was observed with P3 and P3-Cu^{2+}. Our data highlights antimicrobial susceptibility differences dependent upon piscidin isoform. Each PUFA caused a distinct change in membrane permeability, while the effects of each piscidin was variable. In *V. vulnificus*, at least one PUFA raised the MIC of each piscidin. All PUFAs lowered permeability, but significant piscidin- dependent effects were observed with P1 only. The data herein sheds light on bacterial membrane dynamics regarding piscidin activity and PUFA mediated effects.

P123 - Development of microsatellite markers for *Huperzia lucidula* the Shiny Firmoss.

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Huperzia lucidula belongs to the ancient and complex plant family Lycopodiaceae. This family is poorly understood due to significant evolutionary gaps and hybridization amongst genera. Hybridization is especially prevalent within the genus Huperzia which includes 10-15 species in North America. *Huperzia lucidula* is a hardy species of terrestrial firmoss found throughout North Central and North Eastern America. *H. lucidula* is known to hybridize with sympatric species such as the rare *H. appressa*. Understanding genetic variation within species and populations of *H. lucidula* and *H. appressa* allows for further investigation of this complex genus. This research aims at constructing microsatellite markers for this species complex. To begin, two populations of *H. lucidula* were collected from the Tater Hill Plant Preserve and are being utilized to assay potential microsatellite markers. Development of these markers will allow us to evaluate species and their populations as well as investigate potential hybridization within the genus.

P124 - Polyunsaturated fatty acids (PUFAs) amplify the killing effect of peptide antibiotics in *Aeromonas hydrophila*

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One of the top global threats to public health is antimicrobial resistance. There is an urgent need for development of novel therapeutic regimens that can bypass existing microbial mechanisms of antibiotic resistance. Previous research has established that exogenous polyunsaturated fatty acids (PUFAs) are assimilated into the membrane phospholipids of gram-negative bacteria, thereby altering membrane permeability and susceptibility to antimicrobials. Introducing membrane vulnerability may create opportunities for antimicrobials to diffuse through the outer and inner membrane of gram-negative bacteria. In this study, combinatorial treatment of the human pathogen Aeromonas hydrophila with seven PUFAs (linoleic acid [18:2], alpha-linolenic acid [18:3a], gamma-linolenic acid [18:3g], dihomo-gamma-linolenic acid [20:3], arachidonic acid [20:4], eicosapentaenoic acid [20:5], docosahexaenoic acid [22:6]) and

4 antimicrobials (polymyxin B, colistin, ampicillin, and imipenem) was evaluated using broth dilution minimum inhibitory concentration (MIC) assays. Significant changes in MIC were observed, particularly with the cyclic peptides polymyxin B and colistin, wherein most PUFAs significantly lowered the MIC by a range of 4 – 64-fold. Minimal changes to MIC were observed for ampicillin and imipenem, antibiotics that access bacteria through a protein-mediated process. Collectively, this data highlights not only PUFA-mediated biomembrane effects, but also the potential for PUFAs and membrane-attacking antimicrobials to synergistically target gram-negative infections.

P125 - What's in a Name? Microsatellite Analysis of Rice Varietal Diversity in Madagascar

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Oryza sativa is the most widely consumed grain worldwide and constitutes 55% of the caloric diet of Malagasy peoples. While the rich, endemic biodiversity of Madagascar is well studied, far less attention has been devoted to understanding the introduced crop diversity. A 2019 survey of rice varieties grown by 73 households around the Betampona Nature Reserve in East Madagascar identified 81 locally named varieties. Previous researchers found a large number of synonyms and homonyms among named Malagasy rice varieties. This study seeks to determine the relatedness of those named varieties by conducting a microsatellite fingerprinting analysis of *O. sativa*.

Eighty fresh tissue samples were collected along with varietal names and specific collection coordinates. These samples were subjected to a modified CTAB extraction before conducting PCR using thirteen primers established by previous studies. Microsatellite bands were scored using a 50bp ladder on 3% agarose gels run for 3 hours at 50V. Comparing the relatedness of these varieties with the techniques used to produce them in various locales will assist in the development of further agriculture extension programs and could potentially improve crop productivity.

P126 - Annual Temperature Variation Effects on *Vibrio spp.* Population in Oysters (*Crassostrea virginica)* from Georgia's Coast

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Vibrio parahaemolyticus bacteria are frequently found in shellfish, including oysters, and are the leading cause of seafood-borne illness in the United States. As Georgia's coastal region is looking to expand upon their current oyster mariculture industry, we assessed the presence of V. parahaemolyticus in oysters during the harvesting and non-harvesting seasons and investigated if these bacteria possess antibiotic resistance. Our study focuses on 4 sites on Sapelo Island, which are located near areas of potential mariculture development. Oysters have been collected in batches of ten every 8-10 weeks throughout 2023. Following collection, samples were homogenized and diluted in 0.9% normal saline before being plated on CHROMagarTM Vibrio. After overnight incubation at 37°C, colonies were counted to quantify bacterial load per gram of oyster tissue. These bacteria were further examined for antibiotic resistance patterns using antibiotic MIC strips and compared with CLSI standards. Thus far, our results indicate that the concentrations of V. parahaemolyticus are very close to, or exceeding, FDA regulations for safe consumption at the cusps of the harvesting season. These results suggest that V. parahaemolyticus concentrations increase as water temperature increases and decrease to almost undetectable levels at the coldest temperature. The quantity of V. parahaemolyticus within these oysters at higher temperatures is concerning, but the bacteria present were not resistant to 6 antibiotics typically prescribed to treat vibriosis. This work provides a framework to aid the mariculture industry development on Sapelo Island by monitoring V. parahaemolyticusconcentrations and antibiotic resistance.

P127 - Role of Dinucleotide Signaling Molecule in *Staphyloccocus aureus* Pathogenesis

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Staphylococcus aureus can cause a wide range of infections in humans from skin and soft tissue infections to more severe pneumonia, osteomyelitis, bacteremia, and endocarditis, in part aided by its ability to naturally resist the innate immune system. In addition to its pathogenicity, drug resistant strains have emerged in both community and hospital settings. The ability of methicillin-resistant *Staphylococcus aureus* (MRSA)to resist immune cell-produced nitric oxide (NO·), and to effectively form antimicrobial-resistant biofilms makes it an important pathogen to study. Recently, the *S. aureus* enzyme YqeK was discovered to degrade the dinucleotide molecule, Ap4A, which has not previously been studied in *S. aureus*. In other bacteria, elevated Ap4A reduces antibiotic and stress resistance as well as biofilm formation. Here, we created a ΔyqeK deletion mutant in a community-acquired MRSA strain (LAC) and assessed its fitness during both NO· resistance and biofilm formation. Relative to wild-type, the ΔyqeK deletion strain demonstrated a significantly decreased ability to resist NO·, and a decreased ability to form biofilms on polystyrene plates. Future work will include RNA-sequencing to determine how gene expression differs in the ΔyqeK deletion strain in order to identify a possible mechanism for these phenotypes and further explore the potential of YqeK or Ap4A as drug targets.

P128 - Reducing Bacterial Load on Spinach via Physical and Chemical Methods

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Consumers have access to various chemical and physical methods, such as washing with water, vinegar, baking soda, Veggie Wash, and freezing to reduce the bacterial loads of the vegetables before consumption. This study aimed to: (1) determine the effectiveness of these methods at reducing the bacterial loads on spinach, and (2) identify what species of bacteria were present after cleaning. We used the culture dependent method to compare the abundance of heterotrophic bacteria present after washing. Our results show that by washing spinach with 25% vinegar, the number of bacteria was reduced by 4 orders of magnitude after 1 minute of washing. Our results also show that when immersing spinach in baking soda for 4, 12, and 15 minutes, a similar number of bacteria is dislodged when immersing spinach in water ($p > 0.05$). Veggie Wash and water dislodged a similar number of bacteria from spinach after washing ($p > 0.05$). Either after refrigeration or freezing, the bacterial loads remained higher on bagged spinach than on their bunched counterparts. We isolated and identified 48 presentative bacteria, each from spinach that were bagged frozen, bagged refrigerated, bunched frozen, and bunched refrigerated. Frozen bagged and bunched spinach had higher alpha microbial diversity than their refrigerated counterparts. We also isolated and identified 24 presentative bacteria, each, from vinegar-treated bagged and bunched spinach. Both vinegar-treated bagged and bunched spinach had lower microbial diversity than their untreated counterparts. The vinegar-treated bagged spinach had the lowest diversity of all the samples measured. To summarize the findings of our study, vinegar wash and freezing decreases the bacterial abundance and diversity present on spinach and the bacterial load present on other leafy vegetables with 10 seconds of washing. A baking soda immersion and Veggie Wash was as effective as water treatment for dislodging bacteria from spinach.

P129 - Effects of D- and L-amino acid derivatives on biofilm inhibition

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Antibiotic resistance is a significant problem in our society that has increased in recent years due to the over prescription and misuse of antibiotics. A major contributing factor of antibiotic resistance is the production of biofilm, an extracellular matrix often composed of polysaccharides, proteins, and DNA that protects bacterial communities from the body's immune system. Production of biofilm is regulated by quorum sensing. Quorum sensing is a form of cellular signaling which allows bacteria cells to communicate information about population density. Once a peak population is reached, bacteria initiate the formation of biofilm. Inhibition of quorum sensing pathways can lead to a decrease in virulence factors such as biofilm. To this end, we designed small molecules capable of inhibiting biofilm formation through the creation of quorum sensing mimetic compounds that would potentially interact with cellular receptors, however, fail to produce an intracellular response. Thereby, these compounds were proposed to inhibit the ability of bacteria to sense density and therefore prevent biofilm formation in high density populations. Initial studies crystal violet of six of these compounds, Gly-15, Phg-15, Pro-15, Trp-37, Tyr-15, and Tyr-45 in *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Streptococcus mutans* using crystal violet staining demonstrated a 63.2% biofilm inhibition for Tyr-15 and 91.3% biofilm inhibition in Tyr-45 in *Bacillus subtilis*. Initial disk diffusion, planktonic, and use dilution assays indicated that the drugs were diminishing biofilm without bacteriostatic or bactericidal effects. We have continued studies on these two compounds and are attempting to optimize the efficacy of the compounds through stereochemical alterations comparing the D- and L- amino acids. The next step is to study these compounds in mammalian tissue culture to determine whether they elicit cytotoxic effects. Optimization of biofilm inhibition and demonstrated safety for use in mammalian cells are valuable steps towards therapeutical use.

P130 - Comparative analysis of the performance of the CareSuperb COVID-19 antigen home test with three other antigen tests using SARS-CoV-2 wild type and Omicron variants

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Coronaviruses constitute a large virus family, leading to illnesses ranging from the common cold to more serious conditions such as Middle East Respiratory Syndrome (MERS) and coronavirus disease 2019 (COVID-19). Rapid self-antigen test kits for COVID testing play a pivotal role in controlling the spread of the virus by promoting early detection. *CareSuperb*™ COVID-19 antigen Home Test kit (CareSuperb) was developed by Access Bio, Inc. and will be commercially available for self-COVID testing. In this study, the sensitivity of CareSuperb was compared with the sensitivity of BinaxNOW™ COVID-19 Antigen Self-Test (BinaxNow) (Abbott Diagnostics), Flow*flex*™ COVID-19 Antigen Home Test (Flowflex) (Acon Laboratories), and InBios SCoV-2 Ag *Detect*™ Rapid Self-Test (InBios) (InBios International) using wild type (USA-WA1/2020) and two different Omicron SARS-CoV-2 variants (B.1.1.529 and BA.2.75.5). Briefly, multiple two-fold serial dilutions of virus samples were prepared using phosphate buffered saline. The samples were applied to swabs in 50 microliters and tested in triplicates according to the manufacturers' instructions. Our results suggest that CareSuperb is superior compared to other COVID-19 antigen tests, as it demonstrated the lowest limit of detection in all three types of SARS-CoV-2 tested.

P131 - NorA efflux pump inhibition in S. aureus using novel lead compounds in a DiOC3 real-time efflux assay

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Quorum sensing is a mechanism utilized in bacterial strains to communicate between neighboring colonies and assess the strain's population density. Upon surpassing a population density threshold, this mechanism can trigger a population response, such as biofilm production, through the release of signal molecules. Biofilm is an extracellular collection of polysaccharides and proteins that has been observed to provide pathogenic bacteria protection from antibiotic treatment and the body's immune responses. Our lab originally synthesized and tested drug compounds for their potential to reduce or inhibit biofilm production in Staphylococcus aureus (S. aureus) through inhibition of quorum sensing receptor signaling. However, we predicted these tested drug compounds may be reducing biofilm through inhibition of the NorA efflux pump, which has been observed to pump out biofilm forming components. Drug compounds

Proline-61, Proline-68, and Tyrosine-16 were tested using a Crystal Violet Assay against three strains of S. aureus, a wildtype (SA-1199), an overexpressor of the NorA efflux pump (SA-1199B), and a knockout strain missing the NorA efflux pump (SA-K1758). All three drugs demonstrated greater significant biofilm inhibition in the overexpressor than in the wildtype strain and no significant inhibition in the knockout, supporting our hypothesis. However, the Crystal Violet Assay only quantifies overall biofilm production and does not measure the specific activity of the NorA efflux pump. We have developed a fluorescence assay utilizing 3-dipropyloxacarbocyanine iodide, a known substrate of NorA, which will allow us to directly quantify NorA activity and its corresponding inhibition, if any, following exposure to our drugs. We hypothesize that Proline-61, Proline-68, and Tyrosine-16 are inhibiting biofilm production in *S. aureus* through inhibition of the NorA efflux pump.

P132 - Blue coloration in fungi: biochemistry, evolution, and possible functions

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The subject of adaptive coloration in plants represents an area of research that has widely expanded over the last century; yet, adaptive coloration of fungi remains largely unexplored. The objective of the current study was to review the literature for information on the biochemical, evolutionary, and ecological basis for blue coloration in fungi. So far we have so documented blue coloration in 24 fungal genera, belonging to 18 families and 2 phyla. In some lineages, molecules responsible for imparting a blue hue are evolutionarily ancient (e.g. melanins and laccases), while in other lineages, blue molecules are unique to their family (e.g. xylindein- a quinone pigment produced solely by fungi in the genus *Chlorociboria*). In the vast majority of cases, however, the compound(s) directly responsible for blue coloration have yet to be isolated or described in the literature. In many taxa, differently-colored but structurally-related isomers and isozymes of the blue molecule occur within a species (most commonly white, yellow, or brown in color). In some cases, color change may be induced by changing media or growth conditions, but overall, it remains largely unknown why fungi would produce one colored molecule over another. Among the proposed functions of fungal pigments described in the literature include: protection from UV light, warming of sporocarps to create convection and disperse spores, and protection from host defenses. No studies have yet tested for beneficial effects of blue molecules specifically to fungi.

P133 - Microbiota associated with meiofaunal nemerteans reveals evidence of phylosymbiosis

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Phylosymbiosis, the association between the phylogenetic relatedness of hosts and the composition of their microbial communities, is a widespread phenomenon in diverse animal taxa. However, the generality of the existence of such a pattern has been questioned, and there seems evidence against its occurrence in small-sized aquatic animals, for which the microbiota composition is mostly shaped by local environmental factors. This study aims to investigate the microbial communities associated with poorly known marine interstitial nemerteans to uncover their microbiota diversity and assess the occurrence of phylosymbiosis. Through a comprehensive approach, specimens from various Central American sites were analyzed using morphology-based taxonomy and molecular techniques targeting the host 18S rRNA gene whereas their microbial association was analyzed by targeting the prokaryotic 16S rRNA gene. Phylogenetic and statistical analyses were conducted to examine the potential effects of host nemertean taxa and sampling locations on the host-associated microbial communities. The results provide compelling evidence of phylosymbiosis in meiofaunal nemerteans, emphasizing the significant impact of host genetic relatedness on microbiome diversity also in small-sized animals. Additional research is needed to fully unravel potential symbiotic relationships as well as the complex mechanisms that govern the relationships between hosts and their microbiota across various organisms and ecological settings. The remarkable diversity of meiofaunal animals, spanning various animal phyla with different lifestyles and inhabiting diverse ecosystems, combined with the advancements in multi-omics approaches, offers a promising avenue for comprehensive understanding of the evolutionary and ecological interactions between hosts and their microbiota throughout the animal tree of life.

P134 - Leaf Spots Affecting Native Plants of the Appalachians

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The goal for this research project is to determine endophyte species present in leaf spots on native plants along the Blue Ridge Parkway and in Great Smoky Mountains National Park. Endophytes are microbial organisms (mostly fungi) living inside plant tissue, typically without harming the plant. By targeting leaf spots, we are aiming to identify fungi potentially pathogenic to these plants. In total 73 specimens were collected based on the appearance of leaf spots along with unaffected controls. Following collection, DNA was extracted and quantified using Nanodrop and Qubit methods. Specimens with sufficient concentration of DNA were sent off for ITS sequencing to identify endophytes, including samples of *Podophyllum peltatum, Laportea canadensis, Nabalus altissimus,* and *Lilium superbum.* The results of the DNA sequencing show evidence of a large community of endophytes in all plant specimens with 49 fungi of interest identified to species. In addition to Pucciniaceae (expected pathogen, but no perfect species match identified yet), substantial amounts of *Boeremia foveata* were found in Podophyllum peltatum infected samples but not within the control. *Cercospora* was found in only one of the samples, as well as the *Lilium superbum* sample, suggesting that reservoirs of pathogenic fungi (lily leaf spot disease) may exist as endophytes in other plants in a location-specific manner. However, further testing would need to be done for more information. Fungal presence identified in other plants belonged to Basidiomycota, specifically *Cantharellus* and an endophyte species not known to cause any harmful effects, *Aureobasidium pullulans.* In summary, we were able to identify pathogenic fungi comparing infected samples with controls as proof of concept. While the initial analysis found good matches to sequences in the databases, some sequences

show only ~75-95% similarity to the closest match identified. This hints at the possibility of discovering species not yet known to science.

P135 - Inhibition of Staphylococcus Epidermidis Biofilm Using Bacterial Supernatants and Herbal Extracts

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Staphylococcus epidermidis is a bacterium that forms biofilms on medically implanted devices, leading to hospital-related infections. These infections result in poor recovery rates and increased morbidity and mortality. Biofilms are multicellular communities of microbes attached to a surface, bound in an extracellular matrix composed of various exopolymers, including polysaccharides, proteins, extracellular DNA, and lipids. Biofilms provide protection for microorganisms against host immunity and antibiotics. Effective treatments to inhibit biofilm formation or disrupt existing biofilms will reduce the clinical and economic burden of these infections and potentially help limit further antibiotic resistance among staphylococcal species. Our lab has previously shown that Pseudomonas fluorescens culture supernatant inhibits S. epidermidis biofilm formation. The current study aimed to determine if the supernatant can increase antibiotic susceptibility of S. epidermidis when applied together. Certain herbal extracts were also utilized to inhibit and disrupt S. epidermidis biofilms. Taken together, our results suggest that these agents are promising as an alternative and complementary measure to reduce and destabilize staphylococcal biofilm, potentially leading to a clinical application that could significantly enhance the effectiveness of antibiotic treatments for S. epidermidis.

P136 - Identifying A Novel Fungus Using ITS DNA Sequencing

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In November of 2022, a flush of atypical mushrooms was found in Dahlonega, Lumpkin County, Georgia. Samples were collected, and macroscopic and microscopic data were analyzed. An assessment of the environment and time of year they were found was also performed. Our findings did not align with species typical of the area. After consulting the literature, we hypothesized these to be the species Neolecta vitellina Korf & J.K. Rogers (Neolectaceae). To confirm this, we performed PCR to amplify the internal transcribed spacer sequence. The sequence has been compared to the GenBank database, and our DNA was a match for existing submissions of N. vitellina confirming our hypothesis.

P137 - Identification of Antimicrobial Producing Bacteria from Soil Collected in Hampstead, NC

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Antibiotic resistance in pathogens is a worldwide problem. The goal of this project was to screen soil bacterial isolates for antimicrobial production and to determine their identity. The soil was collected in Hampstead, North Carolina and the quantity of microbes was determined. The spread patch method selected and screened twelve isolates to examine antimicrobial production. One isolate, designated MGH09, showed zones of inhibition on multiple control bacterial species and was determined to produce antimicrobials. Phenotypic testing and sequencing of the rRNA gene suggest that MGH09 belongs to the genera *Bacillus* and falls into the group *Bacillus subtilis*. Extractions of the antimicrobials will be performed in order to further analyze the potential of the compounds for inhibitory capabilities.

P138 - A tale of two "species": Investigating structure of *Packera cymbalaria* and *Packera heterophylla* (Asteraceae) using morphology data

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The genus *Packera* within the sunflower family consists of at least 75 species distributed across North America, with one species found in Russia. This one Russian species, *Packera heterophylla*, has a centralized distribution in Siberia, but can be found in North America (Canada and Alaska). Interestingly, *P. heterophylla* shares similar morphologies and ecologies to an already named species *Packera cymbalaria*, that is found only in North America (Alaska and Canada). Given these shared characteristics, and geographic overlap, some botanists hypothesize that they are the same species, though this suspicion has not been confirmed. In this project, the morphological characteristics of *Packera heterophylla* and *Packera cymbalaria* were measured and compared by obtaining herbarium loans across both species' ranges. These morphological characteristics include the following: plant height, number of ray florets, number of flower heads, number of stems, base leaf length, leaf blade length, top leaf length, and number of base leaves. This data was used to compare the two species of *Packera* as well as understand the differences and similarities between these species across different locations: Alaska, Canada, and Russia. The data collected is an important part of understanding some of the complexities of the *Packera* genus, the evolutionary background of *Packera*, and the role location plays in species diversity. This project helps add onto the constantly growing research about members of the sunflower family.

Keywords: Compositae, Inflorescence, Sunflower

P139 - Microbial Xylitol Synthesis

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Xylitol is a naturally occurring five-carbon sugar alcohol. It is predominantly used as a sugar substitute in dietary aides and as a healthier choice for diabetic consumers. It has also been discovered to have restorative properties in the dental field. For instance, studies have established an inhibiting component that prevents further deterioration of the enamel caused by the microorganism Streptococcus mutans. Xylitol is found in a variety of plants, fruits, and vegetables. In addition, it is also synthesized by specific microorganisms. The utilization of xylitol has expanded in abundance over the course of recent decades. The benefits, as mentioned above, come with an expense not solely in monetary value but also in the form of a hefty ecological footprint. In existing industry approaches, converting xylose to xylitol is accomplished through chemical hydrogenation processes. However, this can be bypassed by engineering biotechnological methods to produce xylitol in a superior way. By employing microorganisms that naturally yield xylitol through various microbial conversions, xylitol production can be executed.

P140 - Digitizing the Fungi Collection at the Marshall University Herbarium

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The Marshall University Herbarium (MUHW) is the second largest collection of its kind in West Virginia. Mostly composed of flowering plants, the Herbarium also includes a fungi collection of ca. 1,000 specimens that dates back to 1977, mostly from West Virginia. In order to make this collection accessible, we started its digitization in Fall 2023. The process for digitizing our fungi collection includes photographing the specimens, uploading the images to the Mycology Collections data Portal (MyCoPortal), and manually entering the collection data into the online database. Having a digitized, globally available fungi catalog is important to aid taxonomists, field biologists, ecologists, educators, and citizen scientists in the study of fungal diversity, particularly in such a diverse area as West Virginia, where so many rare species occur. So far, we have digitized and fully transcribed ca. 15% of our collection and we will continue this effort in 2024. Our work in the herbarium is slow but rewarding. We are learning about fascinating fungi and how important preserving them is. Like plants, fungi also tell us about the world we live in, and preserving their presence in time will continue to educate us about our future.

P141 - The root of the problem: examination of nursery bed fungal communities provides insight into white oak seedling health and reforestation

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White oaks (*Quercus alba*) are in decline across the Eastern United States due to a combination of changes in the disturbance regime, pathogen stress, and poor natural seedling recruitment. In addition, reforestation efforts are hampered by high outplanting morality and disease and herbivory pressures that prevent many plantings from reaching harvestable sizes. Generally, outplanted trees are grown in commercial nurseries as bare-root seedlings. However, little attention has been paid to nursery bed conditions and how these might influence ultimate outplanting success or pathogen loads. It is likely that nursey bed conditions impact soil fungal communities, specifically the abundance of plant pathogens, which may colonize seedlings and will influence outplanting success. Further, there is a knowledge gap on how seedling stock type impacts nursery bed conditions. Two-year-old bareroot seedlings (2-0) may have improved outplanting success due to their larger size but may have more opportunities for plant pathogen colonization. Here we collected rhizospheric soils associated with nursery-grown white oaks from multiple white oak genotypes across two stock types (1-0 and two-year-old [2-0]) and across fumigation status (fumigated with methyl bromide and unfumigated). From these, we extracted genomic DNA and conducted metabarcoding to query fungal communities (Illumina MiSeq) targeting the ITS2 region of the rRNA operon. We see that fungal communities were different across the two stock types and across fumigation status. The 2-0 seedlings harbored more ectomycorrhizal and saprobic taxa than their 1-0 counterparts. We also see that the non-fumigated nursery beds had higher relative abundances of key plant pathogenic taxa. Taken together, this work provides valuable information to inform best practices for white oak reforestation efforts.

P142 - The University of North Carolina at Pembroke Herbarium Digitization

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A herbarium is a collection of preserved plant specimens that can be used in many different ways, like academic studies, taxonomic referrals, and public outreach. Digitizing a herbarium's collection allows these specimens to reach a broader audience and not be restricted to the academic realm. Digitization and outreach can be made possible by herbaria databases like SERNEC, or the Southeast Regional Network of Expertise and Collections, which hosts 233 collections across the southeastern United States. Through a collaboration with North Carolina State University, most UNCP Herbarium (PEMB) was digitized for SERNEC in 2017. In 2019, PEMB acquired the North Carolina Zoo Herbarium (NCZP). We are continuing to expand the PEMB collection and are now doing in-house digitization. The PEMB Herbarium utilizes the SERNEC database, making the collection accessible online. Labels can be transcribed and all the crucial information is accessible to the general public. We have digitized ~200 specimens, filed the NCZP

specimens, transcribed hundreds of labels on SERNEC, and georeferenced ~4% of the PEMB collection. Although we made great strides in the summer of 2023, efforts are still ongoing. In-house digitization has expanded PEMB as an educational resource, and we can use this knowledge to teach herbarium digitization and curation to students.

P143 - Corticolous Lichen Diversity on an Urbanized Campus Located in the Rural Southern Appalachian Mountains

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The Southern Appalachian Mountains (SAM) are a known biodiversity hotspot for lichens. Surveys have found between 178-221 lichen taxa, some previously unknown in North America. It is well known that lichen growth is influenced by the predominating light and nutrient environments, air pollution, and for corticolous lichens (those growing on tree bark), bark chemistry and texture. While we have a good, but not yet complete, knowledge of lichen diversity in the SAM, we do not have a comparable understanding of how urbanization in this region affects lichen distributions and abundances. Therefore, we undertook a systematic survey of corticolous lichens on the campus of Appalachian State University. This university has a densely built main campus compressed into a relatively small area of 410 acres within the city of Boone, NC, itself located in a rural area of the SAM. This portion of the campus was divided into 10 distinct areas and 8-10 trees/area sampled for lichens from ground level to 2-3 m height. Samples were removed from each tree, labeled, and placed in envelopes for later ID. Tree species included both native and non-native, deciduous and evergreen species, planted on campus. Replication of tree species was done where possible and at least 40 have been sampled to date. Preliminary results indicate that there are fewer than 25 species of lichens present on campus trees, with evergreen species having the fewest (sometimes none). This represents just 10% of the known lichen diversity in the SAM, which probably results from fewer suitable habitats, resulting from limited campus tree species diversity, prevalence of only highly exposed trees due to being planted widely apart, and from limiting sampling to corticolous species only. While urban campuses can serve as refugia for some lichen species, they appear to maintain only a limited diversity in an urbanized landscape.

P144 - Floristic Survey of Lamar County, Mississippi

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The vascular flora survey of Lamar County, Mississippi is a still-in-progress project that began in 2021 and expected to be completed in 2023. The importance of this floristic catalogue is to document the species richness of vascular plants in Lamar. Having a documented floristic list will benefit future researchers and conservationists by giving them an idea of what historically has occurred in this county. Personal collections, field observations and herbarium specimens sourced from SERNEC were used to document the 1,056 species recorded so far in Lamar County. There are 153 families and 442 genera represented in this Flora. 83 of the species documented are county records. There are expected to be around 1,200 species to be found in this county, due to the variety of environmental aspects such as soil, elevation, and geographical location. Mississippi flora is severely under documented, and this survey will be only the 14th county flora out of 82 counties. A notable find is a small population of Echinacea purpurea (L.) Moench found on the Camellia Lakes property. This population is the Southernmost recorded natural population of Echinacea Purpurea (L.) Moench in Mississippi and found in a prairie remnant plot amongst other standard prairie species. Information about the soil, habitats, history, and geography of Lamar County was also researched and included in this project. All voucher specimens collected during this project are kept at the University of Southern Mississippi Herbarium (USMS).

P145 - Soil fungal community structure in response to long-term soil health management practices in continuous cotton cropping

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There is a growing interest in managing agricultural soils to increase soil biodiversity, but agronomic strategies must balance crop productivity with soil health practices. Despite widespread adoption of management strategies designed to maintain soil health, such as reduced tillage and cover cropping, little is known about how long-term adoption of these practices impact soil biodiversity. Here, leveraging a 42-year continuous cotton cropping experiment, we test how soil health practices impact soil fungal biodiversity and community structure. Soils were collected across two depths (0-10cm and 10-20cm) from plots that had all combinations of nitrogen fertilization rates (+0kg/ha, +70kg/ha), cover crop (no cover crop, Hairy Vetch), and tillage implementation (no till, conventional tillage) for a total of 8 treatments with 4 replications, and across five timepoints in the 2022 growing season (N=320). From these soils, genomic DNA was extracted and fungal metabarcoding was conducted targeting the fungal ITS2 region (primers fITS7-ITS4; Illumina MiSeq). Results indicate that fungal communities shift in their structure across fertilization, cover crop usage, tillage strategies, and across depths and sampling timepoints. Further, fungal richness displayed contrasting temporal patterns dependent on fertilization rate and soil depth. Additionally, we demonstrate fungal functional guilds respond differently across our experimental framework with the relative abundance of litter saprotrophs showing increases in plots with cover crop usage and in deeper soils. Animal parasitic taxa were more abundant in tilled compared to untilled soils, whereas arbuscular mycorrhizal fungal abundance was reduced in fertilized plots, plots with cover crops (Hairy Vetch - legume), and tilled plots, compared to their counterparts. The relative abundance of plant pathogenic taxa increased in plots that had cover crops and in the surface soils. Taken together, these results demonstrate long-term effects of soil health practices for cotton production on soil fungal communities and provides insight into soil biodiversity-based agricultural practices.

P146 - Analyzing Pollen Production, Reproductive Output, and Pitcher Morphology Variation to Monitor *Sarracenia purpurea* var. *montana* Populations in Southern Appalachia

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Sarracenia purpurea var. *montana* is a carnivorous pitcher plant endemic to the southern Appalachian region of North Carolina, South Carolina, and Georgia. It is a Federal Species of Concern under review with the U.S. Fish and Wildlife Service. This study focuses on a population of *S. purpurea* var. *montana*, located in Western North Carolina, that exhibits unique flower morphology. Typically, *S. purpurea* var. *montana* flowers are pendulous and oriented downward with one sepal whorl, one petal whorl, and a smooth style. However, we found a population in which some individuals have intermediate and upward oriented flowers, multiple sepal whorls, multiple petal whorls, and frilled styles. We hypothesized that this atypical flower morphology would be associated with differences in fitness, including reproductive effort (pollen production) and reproductive output (seed production). To test this, we monitored the atypical population throughout the 2023 reproductive season and compared our findings to data collected previously at three other *S. purpurea* var. *montana* sites in western North Carolina. We collected anthers and recorded floral stage and orientation weekly, measured morphological characteristics of the pitchers, and counted seeds once the ovaries had matured. Analyses showed that the reproductive effort, reproductive output, and pitcher morphology of the site's plants are comparable to those at other sites in the region, contrary to our original hypothesis. Future research includes exploring the genetic and developmental mechanisms underlying this population's unique morphology. Comparing morphological and reproductive traits among populations documents the natural variation that exists within *S. purpurea* var. *montana*. Such comparisons can inform conservation efforts by identifying populations that may be of particular interest to preserve.

P147 - The Bishop Museum and University of Hawaii Expedition to Kauai (1930-1931)

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Field trips play an important role in education, and can be important to the world of science beyond educating the participants. Harold St. John, a botanist and professor at the University of Hawai'i at Mānoa led a collections-based field trip to the Island of Kaua'i from December 26, 1930 through January 4, 1931. The attendees of the trip were determined from historic herbarium collections and the University of Hawai'i at Mānoa yearbook from 1931. A record of the trip can be reconstructed through an evaluation of the specimens on deposit at global herbaria. A collection list of Harold St. John collections from the Bishop Museum Herbarium in Honolulu was obtained and reduced to approximately 345 specimens collected on the island of Kaua'i during the dates of the trip. The collection numbers were analyzed, noting any gaps and missing specimens were searched for in the Database of the U.S. National Herbaria. To determine if any specimen could be classified as a type specimen, each species was searched for in Jstor Global Plants. The number of specimens, families, and collection locations was quantified. Through the search of herbaria material documented 2 type specimens, which we determined to represent 2 new taxa during these field trips. An average of 35 specimens were collected per day across 84 families. Collection sites occurred across the entire island but were primarily concentrated in botanically-rich sites in the northern and northwestern parts of the island. This trip shows the value of educational experiences both for the students and educators as well as for the botanical field.

P148 - Physiological Comparison of Pure American and Hybrid American-Chinese Chestnut Hybrids

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The American chestnut (Castanea dentata [Marsh.] Borkh.), once a dominant canopy species in eastern North America, fell victim to invasive pathogens in the early 20th century. The American Chestnut Foundation (TACF) spearheads restoration efforts using backcrossed hybrids with Chinese chestnut (Castanea mollissima Blume) for pathogen resistance. To understand how backcrossed chestnut hybrids (BC1F1 with 75% American genotype and BC3F3 with 94% American genotype) perform compared to pure American chestnut, this study investigated their photosynthetic capabilities and water relations in western North Carolina. Photosynthetic capacity was compared among these three chestnut classes with steady-state light response curves. Dark respiration rates, quantum yield, and maximum photosynthetic rates differed among the three chestnut types, but these did not result in differences in light compensation point, a measure of shade tolerance. In July and August, plant water potential was measured at predawn, morning and afternoon, and leaf gas exchange was assessed in the morning and afternoon under ambient conditions. Blight effects on the 100% stand resulted in small, shrubby plants that differed in size and light environment, so diurnal measurements were only taken in the two hybrid stands. Soil moisture and pre-dawn water potential were generally similar between the two stands, however, there were significant differences in daily gas exchange and water potential, with the 75% American chestnuts generally having higher rates of gas exchange in the afternoon, while also experiencing lower plant water potential and a greater change between pre-dawn and afternoon water potential. These results suggest that the 75% American chestnuts may be better able to perform under moderate atmospherically-induced water stress in the afternoon. Quantifying relationships between water relations, gas exchange, and environmental factors will allow us to evaluate long-term performance and inform robust planting site selection and management practices.

P149 - Cataloguing and Digitizing Specimens of the Violet S. Phillips Herbarium

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Undergraduate research students at West Virginia University Institute of Technology (WVUIT) in Beckley, WV, have been cataloguing and digitizing specimens in the Violet S. Phillips Herbarium since the fall 2022 semester. During this process, undergraduate research students are recording all relevant information into a master document linked to each specimen with corresponding images. In addition, the accuracy of any existing catalogued specimens is assessed using various resources including but not limited to The Flora of West Virginia, 2nd Ed. (Strausbaugh and Core 1977) and PictureThis. Existing taxonomic information is being compared using the USDA Plants and International Plant Names Index databases. Of the current specimens catalogued and digitized by undergraduate student researchers, less than 5% are mounted. Of these, most remain in the original newspapers of collection. Additionally, of these specimens, at least 25% lack basic identifying information including plant name (scientific or common), name of collector, collection location, or date. The little information that is included for these "newspaper specimens" is generally written on the newspaper. The combined effects of unknown specimen number, lack of identifying attributes, and poor specimen preservation have made the utility of many specimens questionable. The primary goal of this research is to: 1) appropriately quantify the number of specimens in the Violet S. Phillips Herbarium; 2) assess the utility of each specimen; 3) provide a learning opportunity to undergraduate students interested in botanical research; and 4) upon completion, make the information publicly available. Once the herbarium is fully catalogued and digitized, future student researchers will develop a publicly accessible web site. Future student research projects may also include using samples in this herbarium for regional population plant genetics studies.

P150 - Differences in sporophyte conducting cell anatomy between two moss species.

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The sporophytes of moss plants are physically attached to the leafy gametophyte throughout their life. They are dependent on the gametophyte for both photosynthates and water, which makes conducting cells (hydroids and leptoids) an important part of the anatomy of the sporophytes. A previous study by an undergraduate researcher in our laboratory of two closely related taxa found that a species with shorter sporophytes (*Physcomitrium pyriforme*) had higher rates of water transport than a species with taller sporophytes (*Funaria hygrometrica*), which contradicted the hypothesis that taller sporophytes, extending beyond the still air of the boundary layer, would have higher rates of water transport. The aim of this study is to test for differences in the conducting cell anatomy between these two moss species, which could be responsible for differences in water transport rates. We used histology methods to fix, embed, and section the middle of the sporophyte stalk, which is where the conducting cells are located, and microscopy to examine, photograph, and quantify the numbers and sizes of the conducting cells. The results revealed differences between the species in both the leptoids and hydroids . This study enables us to better understand and further explore anatomical structures of a species and their relationship with its function.

P151 - The 14 Day Excursion of the Bishop Museum and University of Hawaii to the Big Island of Hawaii

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In the 1930's field trips were taken by Dr. Harold St. John with students and faculty from the University of Hawaii over the winter break to different Hawaiian Islands. These field trips were collections-based and produced a large number of specimens that contribute to our understanding of the Hawaiian flora. This research explored the collections made on the Island of Hawaii in 1931 and 1932. We studied historic St. John collections from the Bishop Museum herbarium, the JSTOR Global Plants database, and U.S. National Herbarium database to compile information about the plants collected during this field trip. All herbarium labels were labeled University of Hawaii and Bishop Museum Expedition, showing a joint venture between the two separate institutions. There were 283 unique collections made on the trip to the Island of Hawaii between December 20th, 1931, and January 2nd, 1932. Collections occurred across the entire island, starting in the southeastern part of the island at Hawaii Volcanoes National Park and working clockwise up to the Kohala Coast in the northwest. Forty-five different families were represented within this collection trip, with 79.7% being angiosperms, 20% ferns, and 0.3% bryophytes. Collections from this trip served as types for 12 new taxa of endemic Hawaiian plants. Dr. Harold St. John's work and scientific discoveries created a large educational advantage for the students that participated in this field trip, as well as creating an educational opportunity for all students of Hawaiian Botany.

P152 - Long-term effects of repeated prescribed fire on longleaf pine growth and structure

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Prescribed burning is a widely used and well accepted land management tool in the southeast and fire exclusion is a disturbance to these ecosystems; however, the effects of prescribed fire are difficult to study at long time scales. Longleaf pine is an ecologically and culturally significant tree with initiatives to restore longleaf pine ecosystems and there is a need for research into how our burning practices affect this species. This project is leveraging one of the longest running ongoing burn studies in the United States to gain a better understanding of the effects of various prescribed burning regimes affect the growth and structure of longleaf pine. We are using dendrochronological methods to sample trees in a longleaf pine flatwood which have been under four burn treatments —an annual, a biennial, a 4-year and fire exclusion— at the Osceola National Forest experimental site maintained by the US Forest Service since 1958. Utilizing increment core samples we are constructing chronologies for each treatment to compare growth rates across treatments throughout the life of the stand. The structure of the stand will also be compared using aerial and terrestrial LiDAR point cloud data. Our goals are to provide information that could validate or amend the current management practices concerning prescribed burning in

longleaf pine systems and determine the effects of long-term regular interval prescribed fire on the growth increment and stand structure of longleaf pine forests.

P153 - A survey of trees, shrubs, and woody vines of Blue Springs State Park and Forever Wild Tract, Barbour County, Alabama, as a part of a Dendrology course at Troy University

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Blue Springs State Park and Forever Wild Tract encompasses approximately 82 ha in the Choctawhatchee River watershed of Barbour County, Alabama. Located in southeastern Alabama, the study area is included in the Level IV ecoregion of the Southeastern Plains known as the Southern Hilly Gulf Coastal Plain. Due to the presence of a natural spring along a tributary of the West Fork of the Choctawhatchee River, the state park was designated and formed in 1963. To increase recreational opportunities on hiking trails and to add natural habitats to the state park, the Forever Wild Program purchased an adjacent tract in 2013. Natural plant communities at Blue Springs State Park and Forever Wild Tract range from hardwood swamp forests and bottomland hardwood forests along the Choctawhatchee River, to southern mixed hardwood forests on river bluffs and along streams, to branch bay swamps, springs, and seepage areas, and upland mixed pine-hardwoods. Ruderal habitats include sandy fields, powerline rights-of-way, mowed lawns, and roadsides. Trips to document and voucher woody plant taxa were initiated August 2023 and continued through November 2023, as a part of a Dendrology course at Troy University. Herbarium specimens were prepared for deposit in The Alabama Natural Heritage Section Herbarium (ALNHS). To date, a total of 137 taxa from 89 genera and 56 families have been collected. Noteworthy species include *Sideroxylon thornei* (G3/S1) and *Stewartia malacodendron* (G4/S2S3). Families with the most taxa present are: Fagaceae (13), Rosaceae (13), Smilacaceae (8), and Ericaceae (7). Approximately 10% of the taxa are considered non-native to the study area.

P154 - Phylogeny and Evolution of Diapensiaceae Pollen Morphology

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Diapensiaceae is a small family of flowering plants within the order Ericales. The family contains 6 genera and 15 species, which are primarily distributed in North America and East Asia. Diapensiaceae native to the Eastern USA include the perennial herbs Galax urceolata, Shortia galacifolia, and Pyxidanthera barbulata. Although pollen morphology is a useful taxonomic character, no studies have characterized the pollen morphology of Diapensiaceae. We collected air-dried pollen from the herbarium vouchers of S. galacifolia and P. barbulata at Appalachian State University. For Galax urceolata, fresh pollen was collected and freeze-dried prior to analysis. Samples were sputter-coated in gold and images captured using a Phenom scanning electron microscope. For each species, size, polarity, shape and colporus charactristic were characterized. We further compared these characteristics to those of closely related families within Ericaceae (Clethreceae and Cyrillaceae), as well as the more basal Marcgraviaceae. As with other Ericales, Diapensiaceae pollen grains were small (10- 25 µm), radially symmetrical, linearly tricolporate (possessing three linear germinal forrows), and isopolar (distal and proximate poles are symmetrical across the equatorial plane). Whereas the ancestral pollen shape of basal Ericales was isodiametric (spherical) to slightly prolate (ellipsoid), Diapensiaceae and its sister taxa were more strongly prolate, although this may be an artifact of the drying process. Exine (outer coating) ornamentation varied throughout the Ericales from foveolate (smooth) to reticulate (netted). Similar variation occurred within the Diapensiaceae.

P155 - *Viola* species found in Pine Mountain State Resort Park, Kentucky

Noel Cawley

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Plant surveys have been performed for four years at Pine Mountain State Resort Park. During these surveys it was noted that some areas had colonies while other areas contained only solitary violets present. The purpose of the current study is 1) determine which species of violets are present, 2) are they colony forming or individual, 3) are the presence of individual species limited by the presence of colony species, and 4) are colony species always present in colonies. Data was collected at three sites within the park; Forgotten Garden, Lost trail, and Clear Creek Trail. Lost trail and Clear Creek Trail are paths and plants are located along those paths. The forgotten garden is a lightly shaded site, that contains many small paths but is not frequented by the public, this site contained no colonies, four species of Violas were present; V. hastata (Halberd-leaved), V. rostrata (long-spurred violet) , V. sororia (common blue violet) and V. triloba (three-lobed violet).Clear Creek Trail has two species that had formed colonies, V. conspersa (dog violet) and V. cucullate (marsh blue violet). V. conspersa is located along the sides of the trail and V. Cucullate is found in the ditches (wetter areas) along the trail. Individual species of V. hastata, V. sororia,V. rostrata and V. blanda (sweet white violet) were also present on Clear Creek Trail. On Lost trail, V. blanda (sweet white violet) formed colonies adjacent to the creek. Viola hastata (Halberd-leaved) and Viola rostrata (long-spurred violet) are also found on this trail, but only as individual plants rather than colonies. V. blanda is a very small plant when compared to V. Conspersa and V. cucullate, it was present when soils were very shallow or essentially non-existent. Seven species of Viola were identified in these surveys.

P156 - Using molecular data to establish the phylogenetic relationship of an unknown species of *Perezia.*

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Species of the genus *Perezia* are flowers in the family Asteraceae that are found across the Chilean coastline and the South American mountain ranges. Previous work has been done to monograph *Perezia* species based on morphology as well as cladistics within the genus. With the discovery of a potential new South American *Perezia* species based on morphological difference, molecular work will be done to confirm its phylogeny. We will be using similar methods used by Beryl B. Simpson et.al (2009) in the paper, **Phylogeny and evolution of *Perezia* (Asteraceae: Mutisieae: Nassauviinae).** DNA was extracted and the internal transcribed spacer region was chosen for amplification and sequencing. The ITS locus serves as a marker for plant taxonomy because it is a conserved locus across the plant kingdom. Hence its participation in this analysis. Sanger sequencing by capillary electrophoresis done at the University of Memphis yielded data that can be assessed by Bayesian, and maximum likelihood analysis to reveal whether the hypothesized species is new. Results will add to existing phylogenetic data, and possibly aid in conservation and horticultural efforts.

P157 - The Vascular Flora of Thompson Creek, Chesterfield County, SC

Bailey Gause, Charles Horn

Newberry College, Newberry, SC

Southern 8ths Farm in Chesterfield, SC, is a property under the care of the Carolina Wildlands Foundation. Comprised of over 1,400 acres, it offers a vast and varying picture of biodiversity in the Carolinas, of which we focused on an approximately 4.75 km portion of the Thompson Creek to survey the floodplain vascular flora. The land's presence within the slate belt, and along the cusp between the Piedmont and Coastal Plain, allows for a unique biological composition with a variety of species from across the state. Over the course of 2023, with seven visits, 340 specimens were collected representing more than 75 families. Each specimen was collected in the field, then processed, and identified. Data regarding each species' propensity for the piedmont or coastal plain was also compiled in order to determine if the property was more consistent with a coastal plains or piedmont floral composition. With ever increasing habitat destruction to make room for human activity, it has never been more important to complete these surveys and evaluate areas of wilderness for the preservation of potentially rare and threatened species.

P158 - Genetic Analysis of Imperiled Mid-Atlantic populations of *Astragalus distortus* (Fabaceae)

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Ozark Milkvetch (Astragalus distortus Torrey & A. Gray; Fabaceae) is a small, herbaceous perennial that is native to the south-central United States and Maryland, Virginia, and West Virginia. Across the south-central U.S. the species is commonly found in sunny glades and grasslands, whereas in the mid-Atlantic states it grows exclusively on shale barrens and is Imperiled (Maryland, West Virginia) and Critically Imperiled (Virginia). This project uses comparative genetic methods to resolve questions about the species' taxonomy, genetic diversity, and evolutionary history. Presently, two taxonomic varieties of Ozark Milkvetch are recognized. Astragalus distortus var. engelmannii can be found in Texas, Louisiana, and Arkansas, overlapping with A. distortus var. distortus, which spans the species' entire range. A population genetic analysis will show if these varieties are genetically distinct and evolutionarily separate groups and will determine if the Mid-Atlantic metapopulation warrants separate taxonomic recognition. Additionally, understanding the genetic diversity within and among mid-Atlantic populations of Ozark Milkvetch will be invaluable for guiding regional and ongoing conservation efforts for this species. Recent fieldwork in the mid-Atlantic showed that Ozark Milkvetch is absent from many of its historical stations, yet also discovered new populations on other high-quality calcareous shale barrens. Therefore, continued surveying is necessary to obtain a more thorough understanding of this species' distribution and to update the species' conservation rankings.

P159 - The Effect of a High Glucose Diet and Artificial Food Coloring on Dopaminergic Neurons in Nematodes

Augusta Smith, R. Antonio Herrera

Baylor School, Chattanooga, TN

This study aims to examine the relationship between diet, stress, and neurodegenerative disorders such as Alzheimer's and Parkinson's disease. Using the roundworm nematode, *Caenorhabditis elegans*, as a genetic model organism, we seek to determine how diets that include high levels of glucose and artificial food coloring may affect nervous system health. Given that the modern human diet includes daily access to many processed foods that are high in sugar and contain food dyes, we are interested in the effect they may have on nervous system health over the *C. elegans* lifetime. Using fluorescence transgenes that allow us to visualize the health of dopaminergic neurons in worms, we can observe the effects diet has on neuron morphology and the behaviors that are governed by these cells. In worms, it has been shown that diet influences the health of the nervous system, and we expect that high glucose levels will lead to a decline in dopaminergic neuron function. This is like the drastic decline in the quality of life in humans with neurodegenerative disorders, and we are furthering this research by investigating how this is affected by the inclusion of artificial food dyes. Here, we report our preliminary findings on the effect of diet and food dyes on the nematode nervous system. The long-term goal of this project is to identify the genes that regulate how dietary intake affects nervous system health.

P160 - Exploring the impact of a science communication lesson on undergraduate biology students' ability to communicate about culturally controversial science topics

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Better communication about science for a more general audience can promote wider engagement, trust, and understanding of science, particularly when it comes to culturally controversial science topics (e.g., vaccines, climate change, and evolution) which may be more difficult to discuss. Undergraduate students span a wide diversity of identities and career paths, so they play an important role as communicators within their various communities, some of which may have negative attitudes toward science. Further, few undergraduate students are receiving instruction on effective science communication. Thus, they feel unprepared to engage in conversations about controversial science topics.

The goal of this study is to develop and test a standard for succinctly teaching science communication to undergraduate students with the hopes of helping them to engage in impactful dialogue with their peers and family. We implemented science communication instruction into an introductory biology course where students were introduced to both effective and ineffective communication strategies and given examples of each. Finally, we interviewed students to see how instruction impacted their experiences in communicating about controversial science topics.

Interviews (n=6, with at least 20 more to come in the Spring) were coded by inductive thematic analysis. Based on our current analysis, three major themes arise. First, we noticed that most students avoided discussing controversial science topics with people who did not agree with them prior to receiving instruction. Many of the students also used more effective communication strategies in their conversations following instruction. Finally, students recognize that science communication skills can be beneficial within their future occupations. These preliminary findings suggest that science communication instruction may be valuable for undergraduate students and help them to more effectively communicate about science.

P161 - The Role of *puf-8* in Reproductive Organ Tumor Formation in *Caenorhabditis elegans*

Leya Alani, R. Antonio Herrera

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Reproductive cancer affects many people and can lead to fertility issues and death, making understanding how genes that prevent tumor formation function vitally important. One such tumor suppressor, *puf-8*, is a conserved member of the Pumilio protein family and normally prevents tumor formation by controlling cell division in the germline of the roundworm nematode, *Caenorhabditis elegans.* This project aims to understand how loss of PUF-8 leads to germline tumor formation in *C. elegans* gonads. Here, we observe the presence of germline tumors using the germline-specific fluorescent reporter, *fkh-6*, driving the expression of the Green Fluorescent Protein (GFP). *C. elegans* nematodes are amenable to genetic analysis because they have quick life cycles, are small, and have transparent bodies that allow us to observe internal structures and examine where the tumors grow. We have found that tumors grow in the spermatheca of *C. elegans* in animals that have lost *puf-8* by mutation and RNA interference. To quantify the size and cell number we visualized nuclei in fixed cells using the DNA stain, DAPI, in germlines dissected from *puf-8* mutants or worms treated with *puf-8* RNAi. Ultimately, we aim to understand what influences tumor formation in nematodes to better understand the role of Pumilio proteins in human reproductive cancer by using a candidate gene approach. Future work will examine how Pumilio interacting genes affect *puf-8* mutant germline tumor size in *C. elegans* nematodes.

P162 - Undergraduate research is associated with higher student MFT scores and graduation rates

Emily Prince, Lisa McDonald

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Involvement in undergraduate research has been reported to have myriad benefits for students, including feelings of accomplishment, learning gains, and improved graduation rates. However, mentoring undergraduate research projects is extremely time-consuming for faculty and may not be valued during promotion decisions. We investigated whether the benefits, both in terms of learning gains and graduation rates, of student involvement in undergraduate research in Lander University's biology department justify the investment of faculty time. We compared the ETS Major Field Test (MFT) scores of students who had participated in undergraduate research projects to those who had not. Using ANCOVA, we found that MFT scores of student researchers were slightly higher, even when controlling for standardized test scores. We also used multiple logistic regression to determine whether undergraduate research was associated with increased 4-year biology graduation rates. To create the model, we considered the students' high school GPA, standardized test score, risk assessment score, Lander University GPA, and whether they participated in undergraduate research. Of these factors, only Lander GPA and participation in undergraduate research were significantly associated with increased odds of graduation within four years. In fact, we found that while a one-point improvement in student GPA (e.g., from a 2.5 to a 3.5) was associated with approximately 6 times higher odds of graduation, participation in undergraduate research was associated with greater than 7 times higher odds of graduation. Overall, our results indicate a substantial benefit of student participation in undergraduate research. Although gains in MFT scores are relatively modest, student researchers have much higher odds of graduating within 4 years, perhaps because they develop a sense of belonging through these research projects. These findings suggest that faculty mentorship of undergraduate research projects is extremely valuable, and should be not only be encouraged but also rewarded during tenure and promotion decisions.

P163 - The Role of SIR-2.2 in Lifespan and Longevity in *Caenorhabditis elegans*

Reyna Park, R. Antonio Herrera

Baylor School, Chattanooga, TN

All organisms grow and develop until they reach adulthood, after which they undergo the process of aging. To understand how organisms age, and what genes are involved in this process, we are using the nematode *Caenorhabditis elegans* as a genetic model organism to study longevity. A major contributor to how an organism ages is the mitochondrion, a subcellular organelle that is necessary

to produce biological energy that powers the cell during the metabolism of food. During the aging process, mitochondrial function can decline and is influenced by both genetics and stress. It was found that the *C. elegans* lifespan is extended by altering mitochondrial function. To better understand how mitochondria function, we are studying the role of a class of genes known to affect lifespan in many organisms, sirtuins. This work presents the expression pattern of the *C. elegans sir-2.2* and begins to test the effects the loss of this sirtuin has on longevity. To examine the expression and subcellular localization of *sir-2.2*, we are using a strain of nematode that has been genome-edited using CRISPR/Cas9 to fuse the Green Fluorescent Protein (GFP) to *sir-2.2*. We examined the developmental gene expression pattern in larval and adult *C. elegans* and observed that *sir-2.2::GFP* is expressed throughout development. We found that GFP appears as small puncta that are consistent with mitochondria. We present evidence that these puncta are indeed mitochondria by counter-staining with MitoTrackerRed.

P164 - Incorporating the Four-Dimensional Ecology Education (4DEE) Framework into biology curriculum to address 21st century problems

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Since the pandemic higher education has been in the process of rapid and fundamental change. Science educators seek to be more prepared to promote the inclusion of the ecological sciences into the curriculum of the biological sciences to prepare students to address 21st century problems (e.g., sea-level rise, loss of biodiversity). To achieve this goal, students need to learn how to think multidimensionally. This presentation introduces faculty to the Ecological Society of America's Four-dimensional Ecology Education (4DEE) Framework. The framework encompasses Ecological Concepts (EC), Ecological Practice (EP), Cross-Cutting Themes (CCT), and the Human-Environment Interaction (HEI) dimensions. Within each dimension are elements of ecological literacy (e.g., community ecology, species interactions). This presentation demonstrates how this framework was used to create a data-centered teaching module for undergraduate courses incorporating the 4DEE Framework. The data centered teaching module uses tree census data from two pre and post disturbance communities and has students compare successional trajectories after a decade of recovery. The module was designed engage students with elements in all four dimensions, EC (e.g., succession), EP (e.g., quantitative reasoning and computational thinking), HEI (e.g., ecosystem services), and CTC (e.g., spatial, and temporal scales). Faculty in attendance will gain an understanding of the 4DEE Framework and be able to consider how they can incorporate the 4DEE Framework into data or lessons that they currently have.

P165 - Characterization of Axon Breakage and Regrowth in *Caenorhabditis elegans* β-Spectrin Mutants

Emily Beardsley, R. Antonio Herrera

Baylor School, Chattanooga, TN

When motor neurons sustain damage, they must be adequately repaired to prevent causing further harm to the nervous system, with improper rehabilitation leading to impaired motor function. In this work, we use the roundworm nematode, *Caenorhabditis elegans*, to study how the Dorsal D (DD) neurons break and regenerate in animals with a mutation in β-Spectrin, a key cytoskeletal component in neurons. We found that β-Spectrin mutant worms grown on normal plate media exhibit severe axon breaks in the DD neurons with different frequencies depending on their stage of development and age. This project seeks to develop a robust method of stressing the nervous system of β-Spectrin mutants so that we can quantify how neuron regeneration occurs and identify the genes that influence the regenerative process. To do this, we have begun swim stress tests on β-Spectrin mutant animals compared to wild-type animals that express the Green Fluorescent Protein transgene in the DD neurons. Using fluorescence microscopy to visualize axon breaks and the subsequent growth cones in regenerating neurons, we can quantify the effects of stress and observe the progression of nerve healing. Here, we report our preliminary findings that β-spectrin is crucial for neuron stress resistance, and how swimming can be used to induce neuron breakages reliably. Understanding how the incorrect guidance of axons occurs after injury can help in the development of new treatments that encourage proper axon outgrowth and prevent additional damage.

P166 - Inclusion of career-related topics into Department of Biology seminar courses benefits students

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Improving student career preparedness through purposeful integration of career competency development within program curricula is receiving increasing emphasis in higher education. To this end, Winthrop University recently implemented a quality enhancement plan (QEP) to improve the career readiness of students as part of its accreditation goals. To contribute to the university's QEP, faculty in the Department of Biology developed and delivered presentations on career-related topics in upper-level departmental seminar courses during spring and fall 2023, which were taught in a synchronous online format. The four presentation topics were writing cover letters and personal statements, resumes and CVs, soft skills in the workplace, and professionalism and social media. The presentations provided technical information and included discussions, with students mostly sharing responses using the Zoom chat feature. At the end of each semester, students enrolled in the seminar courses complete surveys about whether the presentations improved their understanding of the topics and provided helpful information. Across topics, 77% to 95% of students strongly agreed or agreed that the presentations improved their understanding of the topic or how they think about the topic. Over 85% of students strongly agreed or agreed that the presentations will help them develop strong application materials when applying for a job or professional school in their desired career field or provided information that will help them in their future career field. Overall, students reported that the career-related presentations benefited them and helped them prepare for their future careers. Faculty in the Department of Biology will continue incorporating career-related presentations into departmental seminar courses and expect that the presentations will provide similar or greater benefit to students when delivered in-person during future semesters.

P167 - The Role of Paraquat on α-Synuclein Aggregate Formation in a Nematode Parkinson's Disease Model

Juliana Gardner, R. Antonio Herrera

Baylor School, Chattanooga, TN

Parkinson's disease (PD) is the second most common neurodegenerative disease in the world today, with symptoms including tremors, slowness of movement, memory and thinking problems, and pain. While researchers have identified that its onset can be triggered by genetic and environmental factors, many of the fundamental and underlying causes of the disease are largely unknown. Exposure to environmental factors such as metals, pesticides, and herbicides has been shown to influence the development of PD, but the molecular genetic mechanisms by which they impact development are not fully known. The herbicide, Paraquat, has been shown to increase the risk of PD in people exposed, and we aim to understand how this might occur on a molecular level. To determine the effect Paraquat may have on the development of PD, we are using the roundworm nematode, *Caenorhabditis elegans*, to test how herbicide exposure affects the formation of α-synuclein aggregates. Increased aggregate formation in neurons is found in PD, and this study aims to identify genes that regulate this process. We quantify aggregate formation using worms that express a fluorescently tagged α-synuclein in body wall muscle. Using this model, we also investigate the role of TOR-2 as a neuroprotective agent and its potential protection against Paraquat-induced α-synuclein aggregation. We hypothesize that when worms have mutations in familial PD genes as well as paraquat exposure, their α-synuclein aggregation levels will be affected.

P168 - The impact of primary literature-based, critical thinking activities on student attitudes in a graduate-level cell biology course

Jennifer Hurst-Kennedy, Carmen Carrion, Shoshana Katzman

Agnes Scott College, Decatur, GA

MDS-610/Medical Cell Biology is a required, clinical-focused, graduate-level course in the Agnes Scott College Master of Science in Medical Sciences curriculum, which prepares students for careers in medicine and related health professions. In MDS-610, students delve into the study of human diseases and drug therapeutics at the cellular level. Clinical connections to class concepts are examined through primary literature assignments, wherein students analyze peer-reviewed manuscripts on relevant molecular pathologies and therapeutic interventions. The goal of these assignments is to enhance critical thinking skills, a core competency for students entering medical school. Here, we present our primary literature assignment curricular design and our assessment of student attitudes toward the impact of these assignments on their learning gains, the relevance of these activities, and their preparedness for careers in health care.

P169 - The Effect of Caffeine on Learning and Memory in *Caenorhabditis elegans*

Edith Herndon, R. Antonio Herrera

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Caffeine is a common stimulant that is used to enhance wakefulness and to give people a sense of energy throughout the world. Indeed, caffeine is one of the most consumed substances in the world, and understanding how it can affect learning, memory, and behavior on a molecular genetic level is poorly understood. This project seeks to uncover the molecular genetic mechanisms that underlie memory formation and the execution of motor behaviors. We are using the roundworm nematode, *Caenorhabditis elegans*, as a genetic model organism to study the effects of caffeine on a common avoidance behavior. *C. elegans*, despite having a relatively simple body plan, has a robust set of behaviors and learned responses that make it very useful to study how memory is affected when exposed to caffeine. Since the entire connectome of their nervous system has been mapped, this makes *C. elegans* very useful for testing how learning, memory, and behavior are controlled on a genetic level. Here, we have constructed a machine that allows us to investigate the effects of caffeine on the formation of short-term memories in response to a plate-tapping stimulus, which induces worms to do a reversal and swim backward after perturbation. After repeated exposure to stimulus, the number of reversals is reduced, as the worms learn to tolerate this input. Ultimately, we aim to identify how caffeine affects this avoidance behavior and the subsequent memory formation.

P170 - Perception of and participation in programs to support the success of nontraditional transfer students in a STEM major

Shannon Pittman, Leigh Hester, Adam Lewis, Derek Newland

Athens State University, Athens, AL

Transfer students face additional barriers to degree completion compared to non-transfer students. Athens State University implemented the Athens State Scholars in STEM program (ASSIST) to improve the success of high-achieving, low-income transfer students in the following majors: Biology, Chemistry, Computer Science, Information Technology, and Mathematics. We implemented support programs aimed at decreasing time to degree completion (STEM orientation course, faculty advising), increasing retention (online tutoring, peer support activities, biweekly support emails), and inspiring students to stay in a STEM major (conference travel funds, STEM seminar series). We investigated whether enrollment status (full time or part time) influenced participation in and perception of support programs. We additionally investigated whether perception of support programs changed with time in a STEM major. We did not detect a difference in perception of support programs with enrollment status. However, we found that students enrolled full time were more likely to participate in support programs. Student perceptions of support programs designed to keep students in a STEM major improved with time in the program, likely because students were more likely to use conference travel funds as they neared graduation. Because switching away from a STEM major often occurs in the first semester post-transfer, support programs designed to inspire students to stay in a STEM major should be accessible during this initial semester.

P172 - Living Shorelines are the CURE: Inquiry Based Lab Exploring Shoreline Solutions for Sea Level Rise

Dr. Sarah Wofford-Mares

Florida State University Panama City, Panama City, FL

Coastlines worldwide face chronic and acute stressors which pose issues not only for the organisms that live in these habitats but also human populations in the coastal zone. Global climate change, coupled with increasing sea rise has introduced a variable stressor with which organisms and human development must contend. Moreover, acute stressors like habitat loss to anthropogenic development and eutrophication can compound long-term stressors, imperiling ecologically and economically important coastal systems. Specifically, increased use of shoreline hardening methods designed to reduce erosion are having inverse impacts on biological diversity in coastal zones around the Gulf of Mexico. A multi-institutional team was awarded a grant to (1) quantify the current hydrodynamic state of shorelines in coastal Alabama rivers, (2) evaluate impacts of private property shoreline management decisions on nearshore habitat, (3) design and model test alternative shoreline management options, and (4) produce usable products for stakeholders to increase use of living shoreline methods on private property. This poster highlights one of those products, a course-based undergraduate research experience using simple data collection methodologies. In Fall 2023 introductory biology students at Florida State University, Panama City, collected environmental data along armored and natural shorelines to assess the ecological impacts of different shoreline stabilization methods. Beach profile data was collected using the Emory method, wave energy data was collected using marked poles and cell phone video, and biodiversity data was collected using a PVC quadrat and the cellphone app "Seek." The purpose of this poster is to outline the simple methodologies used in this course to assist others in implementation. Moreover, the poster will convey best practices for "scaling up" or "scaling down" the methodology in terms of both complexity and cost. Finally, real student data and conclusions will be on display as well as next steps for the project and course design.

P173 - The Characterization, Identification, and Parasitology of a Blue Biofluorescent Millipede Species

Claire Ellish, Addison Greene, Michelle Jiang, R. Antonio Herrera

Baylor School, Chattanooga, TN

Millipedes are a group of arthropods that live as detritivores and function to break down decaying plant matter on the forest floor. Millipedes are a segmented species with dorsal and ventral segments that overlap. These armor plates provide one form of defense in addition to the release of cyanide gas when they feel threatened. In the Baylor School in Chattanooga, Tennessee, we isolated an unknown species of millipede that grows under decaying logs across the school campus. This species can bio fluoresce when exposed to ultraviolet light, which many, but not all species of millipedes can do. Serving as a possible warning signal to potential predators, we are interested in the chemical composition of the fluorophore. Additionally, we have characterized the morphology of the adult males and females, as well as performed scanning electron microscopy to scan the surface of newly hatched juvenile millipedes. To identify the unknown species, we have isolated genomic DNA for sequencing and aim to determine to which species of millipede the Baylor isolate is most closely related. Lastly, we are examining the health of the millipedes by quantifying the number and types of parasitic nematodes found in their digestive tract.

P174 - Using Three-Dimensional Technology to Enhance Learning

Sidney Karnes

Concord University, Athens, WV

Adding three-dimensional printing as a regular class activity could pique interest and learning for students throughout many subjects. After being properly educated on the technology, instructors should be given the opportunity to utilize three-dimensional printing technologies to enhance learning in their classroom. Using this technology could provide a better understanding of different topics for more students than a traditional lecture-style learning environment. The aim of this project is to evaluate the interest and learning of students in STEM and protein structure and function specifically before and after using three-dimensional printing technologies through integration in a biology seminar course. Students are expected to research a protein of interest, write a report, print the protein, and make a poster to support their presentation and aid in understanding of the protein's functions. A questionnaire will be sent out before and after students present their protein research to evaluate changes in interest and learning.

P175 - The Role of Hox Genes in Sea Squirt Metamorphosis and Regeneration

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Ciona intestinalis sea squirt is a marine invertebrate model organism used for understanding the molecular genetics of evolution, development, metamorphosis, and regeneration. Having a biphasic life cycle, *Ciona* develop as motile free-swimming larvae and under the correct conditions, undergo metamorphosis into sessile adults. As a basal chordate, *Ciona* is used as a genetic model organism because it has a short lifespan, is transparent, and is the closest invertebrate to all other vertebrates. The *Ciona* life cycle is unique and presents an opportunity to study the process of neural genesis as the larval organism transitions into the adult form during metamorphosis. The Hox genes are a family of homeobox-containing transcription factors that are known to regulate body plan formation during embryogenesis, but their role in *Ciona* metamorphosis remains unclear. To better understand how Hox genes affect the development of the nervous system in sea squirts, we are using CRISPR/Cas9 technology to perform genome editing and generate mutations in the Irx/Hox gene that is enriched in nerve precursor cells. We have designed a set of 3 guide RNAs to edit the genome within the start of the Irx gene. To confirm the presence of successful CRISPR/Cas9 activity, we performed deep sequencing of the Irx

location in the genome. Here, we present our preliminary findings about the role of Irx in sea squirt metamorphosis using fluorescent microscopy to visualize the nervous system of genome-edited Irx mutants.

P176 - How Bird-Friendly is Your Campus? A Conservation Course Project to Develop a Checklist to Assess How Well Campuses Support Birds

Darlene Panvini

Belmont University, Nashville, TN

With the loss of nearly three billion birds since 1970, bringing attention to bird-friendly policies and actions can be a significant way to engage students in local conservation efforts. Nashville, Tennessee recently became part of the U.S. Fish and Wildlife Service's Urban Bird Treaty (UBT) program with a goal to protect and enhance bird-friendly habitats, reduce hazards to birds, and connect people to nature through bird-related activities. To support these aims, and in consultation with local UBT constituents, an assignment was developed for students in a conservation biology course to develop a checklist of campus bird-friendly criteria. Working in groups, students researched potential hazards and ideal habitats for birds on college campuses. They then developed a checklist covering various bird-friendly criteria, including landscaping, water sources, windows, lighting, use of pesticides, and presence of cats and other bird predators. Students beta-tested the checklist on the Belmont University campus and presented their results in an animated presentation. The goals of the course project were to engage students in learning about urban bird-friendly criteria, apply that information to develop and test the checklist, and create a tool that can be used by other universities to assess their campuses for characteristics that support birds. The process of guiding students through the assignment, checklist, course project details, and assessment will be presented.

P177 - Transgenerational Effects of Atrazine on *Caenorhabditis elegans* Brood Size

Rachel Chen, R. Antonio Herrera

Baylor School, Chattanooga, TN

Pesticides are utilized in agriculture to kill unwanted pests and aid in the growth of the desired crop by inhibiting the spread of those organisms. Unfortunately, broad-spectrum pesticides target multiple species and often kill or accumulate in non-target organisms, resulting in unintended health consequences. Atrazine is an herbicide that is toxic to the reproductive, immune, and nervous systems of biota. To study the effect of atrazine exposure on the reproduction of non-target organisms, we are using the roundworm nematode *Caenorhabditis elegans* as a model organism. Here, we treated nematodes to atrazine using various methods of exposure and quantified the brood size of pesticide-treated worms. Fumigation will be used to mimic the agricultural application of the herbicide. We found that fumigated worms treated with atrazine have a decreased brood size. By comparison, we also quantified brood size in worms grown on growth media containing atrazine. We found that brood size decreased, suggesting that atrazine has powerful off-target effects in the first generation after exposure; however, whether these changes will last over multiple generations is unknown. With pesticides being incorporated into 1-10% of water bodies, human over-exposure to pesticides such as atrazine poses a major problem if the side effects persist over multiple generations.

P178 - Increasing Retention in Online Natural Science Courses by Implementing Self-Selected Flex Groups

Sara Cline

Athens State University, Athens, AL

Attrition from online courses can be as high as 80%, especially in the natural sciences. In an attempt to increase retention at Athens State University (AtSU), a small change was made to two different online courses, one a more traditional Human Anatomy course and the other an online Course-based Undergraduate Research Experience (CURE) course utilizing the Characterizing Our DNA Exceptions (CODE) curriculum. Using the same curriculum as prior years, a change was made to the method of online group assignment. Instead of assigning students to groups, students were allowed to self-select into groups based on three different schedule formats: completely asynchronous work, distance synchronous with group mates (video chats, etc.), or synchronous at a preset time with the professor. Overall retention rates were compared among courses with and without self-selection groups. It was found that implementation of these flexible group options brought attrition rates in line with traditional courses at AtSU. In addition, completely asynchronous and preset synchronous groups were the most preferred by the students, generally resulting in an approximately 40:40:20 split in self-selection among the students. This data suggests that a simple change in group assignment, providing a self-selected flex format option, can increase online course retention by as much as 40% for online science courses.

P179 - Automating Invasive Species Analysis: A Case Study of Bamboo Detection and Identification Using Artificial Intelligence and DNA Barcoding

Mazie Mitchem

Baylor School, Chattanooga, TN

Invasive species inarguably disrupt the natural equilibrium. As the prevalence and severity of non-native alien species has grown, so have efforts to mitigate their effects on indigenous wildlife. It has historically been difficult to track the expansion of an intruder due to the sheer scope of the territory covered and the unreliability of manually denoting areas of concern. These obstacles are particularly apparent in the evaluation of bamboo, as although the group is native to every temperate continent, 232 species are currently classed as invasive to North America. The morphological diversity of bamboo obscures attempts to classify individual stands, its rhizome root system threatens the stability of deciduous forests, and its migration is propelled by warming climates. To eschew first the scope and

efficacy problems, we present an automated solution: using an individualized machine learning algorithm to detect stands of bamboo from satellite imagery. The algorithm, a convolutional neural network, utilizes Google's TensorFlow deep learning architecture and the Keras application programming interface, undertaking the unique task of differentiating bamboo from deciduous canopy with greater than 90% accuracy. Once stands are distinguished, the algorithm compiles images of the same coordinates to approximate the growth of the stand over time. Local stands were sampled and classified using DNA barcoding and Sanger sequencing to further evaluate the robustness of invasive versus indigenous bamboo in Eastern North America. Results indicate that alien and native species are almost equally prevalent and that patterns of invasive intrusion reflect human ecological influence.

P181 - Implementation of a Multi-Year Pre-Collegiate Biomedical, Engineering, Environmental, and Sustainability Science Research Program

R. Antonio Herrera, Benjamin Holt, Louie Elliott, Nastassja Hagan, Jesse Young

Baylor School, Chattanooga, TN

Baylor Research is a pre-collegiate research program that includes Biomedical, Engineering, Environmental, and Sustainability topics. The mission of Baylor Research is to teach students to think like scientists and engineers through cutting-edge research projects taught by experts in those fields. This program was established in 2016 and has grown to support dozens of research students within the curriculum in the 23-24 school year. Five science electives (Engineering Design, Molecular Methods, Research I, Advanced Research, and Thesis Research) have been developed to support breadth and depth in these topic areas. Core research concepts and projects have also been implemented in the main curricular courses as well as Advanced Placement science courses. This work presents the infrastructure and methodology for successfully incorporating basic science research topics and techniques in a high school classroom. Additionally, college preparedness and matriculation into STEM-related college fields are discussed.

P183 - Implementation of an eDNA Program to Monitor the Endangered Laurel Dace (*Chrosomus saylori*)

Molly Kate Dickson, Ava McCoy, Finn Ryan, Benjamin Holt

Baylor School, Chattanooga, TN

The Southeastern United States boasts the highest freshwater diversity in the temperate world, containing over 550 species of fish. Anthropogenic activities have led to the decline and imperilment of freshwater fishes, particularly endemic species with narrow distribution and strict habitat requirements. The Laurel Dace (*Chrosomus saylori*) previously occupied eight streams in three systems but recent surveys have documented declines or possible extirpation at all sites. eDNA provides a non-invasive alternative to traditional sampling methodologies and can be effective in detecting small species in difficult-to-sample habitats. Additionally, metabarcoding of local fish communities can be informative for identifying candidate reintroduction sites. To aid in ongoing conservation efforts, our study implements a two-pronged approach using standard metabarcoding and probe-based qPCR assays to potentially detect new, or elusive populations of Laurel Dace while additionally characterizing fish communities on Walden Ridge. We first attempted to validate methodologies using controlled and unknown samples. Preliminary results show consistency with field sampling, and we hope to expand our eDNA program to other sites in the future. Our results hope to highlight the utility of eDNA programs for monitoring and surveying aquatic organisms, particularly those with high conservation priority.

P185 - Molecular identification and microplastic accumulation in Asian clams (*Corbicula fluminea*) along the Tennessee River

Harper Kelly, Benjamin Holt

Baylor School, Chattanooga, TN

Anthropogenic activities are linked to a worldwide decline in the quality and condition of freshwater ecosystems. Two of these pervasive threats come in the form of microplastic pollution and invasive species stemming from a global homogenization of biodiversity. One of the most notorious freshwater invaders, the Asian clam (*Corbicula fluminea*), has become established worldwide, outcompeting native species and disrupting ecosystem function. Genetic analyses have proven useful for tracing invasive species, but lineage description has yet to be carried out Asian clams found in the Tennessee River. Furthermore, while clams have been hypothesized to serve as bioindicators of microplastic pollution in lentic habitats, investigations of the relationship between microplastic bioaccumulated in clams, sediment, and water are currently lacking. We seek to address this gap by comparing the abundance of microplastics in Asian clams to the surrounding environment in urbanized portions of the Tennessee River, while also providing lineage reconstruction of Asian clam invasion in the southeastern United States. The results of this study provide lineage-level clarity for Asian clams in the Tennessee River while also evaluating their proficiency to serve as bioindicators of microplastic pollution in lotic systems.

P187 - Trends in Duck Sex Ratios of Twenty Species in Eastern North America

Luke Thompson, Benjamin Holt

Baylor School, Chattanooga, TN

RA Fisher and Carl Düsing are known for seminal works in understanding the evolutionary mechanisms of adult sex ratios. Negative frequency-dependent selection could promote the stable maintenance of approximately 1:1 male-to-female ratios. However, many populations exhibit skewed ratios, particularly those in need of conservation. In North American ducks, offspring ratios are approximately equal, but adult sex ratios tend to be male-skewed. Furthermore, many species have not been recently, if ever, assessed. Here, we use banding data to estimate the sex ratio of 20 duck species in eastern North America. After standardization, preliminary

results suggest variable sex ratios with some evidence of higher male skewness in diving ducks. We hope to expand our investigation in the future to assess temporal variation in ratios in the context of species trends to understand the potential interactions between population declines and skewed sex ratios.

P189 - The Quantification of Sulfamethoxazole Resistance Gene (*sul1*) In the Tennessee River

David Wang, Benjamin Holt

Baylor School, Chattanooga, TN

Advancements in medical technology, specifically the development of antibiotics, have revolutionized patient care and enhanced quality of life over the last century. However, antibiotic resistance has become a growing concern given the widespread use of antibiotics in medicine and agriculture. The relationship between pathogenic bacteria and antibiotics is an evolutionary arms race in which bacterial infections become more difficult to treat once resistance is acquired, rendering traditional antibiotics ineffective. Wastewater treatment plants have been hypothesized to serve as reservoirs of antibiotic-resistant genes, with horizontal gene transfer allowing for the rapid spread of antibiotic-resistant genes (ARGs) in bacterial communities. Sulfamethoxazole (SMX) is a commonly used antibiotic with a well-documented history of resistant genes. In this study, we assess the prevalence of SMX resistance in the Tennessee River upstream and downstream of a wastewater treatment plant. We use 16S rRNA metabarcoding to characterize bacterial communities and then assess the prevalence of ARG in a common resistance gene, *sul1*. The results of this study will identify the prevalence of SMX resistance in the Tennessee River while also implementing a campaign targeting responsible antibiotic use and disposal in Chattanooga.

P192 - Evaluating tree frog habitat use in a montane wetland environment using tree tube shelters.

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Vernal pools and ephemeral wetland environments are breeding sites for a variety of amphibian species. When human activity and development is adjacent to these environments, it is crucial to continually survey and monitor the aquatic-breeding species in order to determine biodiversity as well as species richness in the wetland concerning season, weather, and species competition. This study examines the life history, abundance and habitat use of Cope's gray treefrogs (*Hyla chrysoscelis)* as well as the spring peeper (*Pseudacris crucifer)* within a montane wetland in western North Carolina over a span of 10 months from August to March. These species are documented at the site, but have not been monitored systematically. We monitored biweekly an array of 40 PVC pipes, placed on trees throughout the wetland along vernal pools, as a means of determining treefrog habitat use. Beginning in January, we also conducted calling surveys for breeding adults and pond sampling for larvae to evaluate the ability of our tubes to detect these species when they were present. This combined approach allowed us to quantify their relative abundance throughout the pre- to post-breeding seasons and their movement throughout the environment.

P193 - Oral Healthcare Barriers Among Dalton State College Students

Ivy Harwood, Kimberly Hays

Dalton State College, Dalton, GA

Within the United States, access to health insurance has improved for many since the passage of the Affordable Care Act; however, barriers to oral healthcare persist financially, structurally, and perceivably. Individuals who lack dental insurance coverage have four times the rate of unattended dental needs than individuals with private insurance (Allukian, 2008). With the lack of insurance coverage, many resort to the emergency department for urgent dental care and spend, on average, $760 per visit (Weiner, 2015). Interested in seeing the barriers to oral healthcare among Dalton State College students, we conducted an online survey via Qualtrics to obtain data to evaluate these barriers. The survey, modified from the Oral Health Workforce Research Center (2019), was distributed to 3,377 non-dual enrolled students all over the age of 18 from April 5th, 2023, through May 1st, 2023. The survey was completed by 221 (6.5%) students from various majors and academic standings. Our results indicate that barriers to oral healthcare accessibility among Dalton State College students stem from a lack of insurance coverage, busy school/work schedules, dental anxiety, and poor oral health literacy. When asked what difficulties students face seeing a dental professional, 26.7% of respondents indicated they could not afford a provider, and 10.4% indicated that many providers do not accept Medicaid or other government-subsidized insurance programs. The survey also noted that oral health literacy and attitudes varied widely among participants, and some relationships were seen between students' majors and these metrics.

P194 - Comparative Behavioral Analysis of *Bombus impatiens* and *Apis mellifera*

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The complexities of Honey and Bumble bee behavior are well-studied. Yet, given the extensive amount of interaction between these main pollinators among shared resources such as Goldenrod, there is little research comparing how they forage. Especially considering the differences in anatomy, body size, and life history strategies, the costs and rewards of foraging strategies differ accordingly. We hypothesized that native bees spent significantly more time foraging at each inflorescence than introduced bees. We attempted to utilize the principle of optimal foraging behavior and the physics involved in foraging to analyze videos taken on the Boone Greenway, the Middle Fork Greenway, and Moses H. Cone Memorial Park along the Blue Ridge Parkway during the late season. The species of pollinators present, interactions, food resources, and time spent foraging at each inflorescence were analyzed. Foraging effort

comparisons were thoroughly investigated by focusing on time proportions. These results contribute to a better understanding of the roles that Honey and Bumble bees play in their floral communities and explain the complex interactions between them.

P195 - Parasites of the Brindled Madtom, *Noturus miurus*, from Western Tennessee: Where are the worms?

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We sampled 40 Brindled Madtoms from two localities in Town Creek, Henry Co., western Tennessee, in late summer-early fall 2023. Fish were electroshocked from a West TN River Basin Authority (WTRBA) stream restoration site and an unrestored section of the same creek approximately 0.75 Km from the restoration site. In the laboratory, we collected host life history data and used otolith analysis to determine age. All Madtom's visceral organs and musculature were examined for helminth parasites. We will report on the helminth fauna of these catfish and make preliminary comparisons between the parasite community structure of madtoms from these two localities.

P196 - Effects of Postnatal Hypothyroidism on Maternal Compulsivity and Anxiety

Joshua Thorpe, Katharine Northcutt

Mercer University, Macon, GA

Thyroid hormones play a crucial role in nervous system development and function. The thyroid is prompted by thyroid stimulating hormone (TSH) to produce triiodothyronine (T3) and thyroxine (T4), which function as regulators in the endocrine system. When the thyroid is impaired, T3 and T4 levels drop despite accumulating TSH levels, culminating in the clinical manifestations of hypothyroidism. Hypothyroidism has severe implications for development, and gestational hypothyroidism is often associated with higher rates of ADHD and cognitive impairments in the offspring (Salazar, 2019). Additionally, previous studies of hypothyroidism in developing rodents showed long-lasting effects of prenatal and early postnatal hypothyroidism on anxiety and impulsivity (Moog, 2017). Recently, our lab conducted a study examining the effects of acute and chronic early postnatal hypothyroidism on maternal behavior in rats. Our data showed faster retrieval times and more overall pup contact in mothers with hypothyroidism during the postpartum period. In order to understand our findings, we aim to parse the underlying behavioral effects of postnatal hypothyroidism on maternal behavior. We hypothesize that heightened anxiety or compulsivity due to hypothyroidism influences these aspects of maternal behavior, as observations indicate frantic and compulsive behavior throughout retrieval testing and general maternal activity. Long Evans rat dams had their thyroid hormone production reduced beginning from birth until the pups are 21 days old via methimazole (0.02%) in drinking water. We are using the Elevated Zero Maze (EZM) to measure anxiety and the marble burying assay to measure compulsivity. Dams will undergo marble burying and EZM assays 10-14 days after birth, with their pups undergoing the trials in the juvenile period and during adulthood. We predict observing an increase in burying compulsion in hypothyroid rats compared to controls, in addition to heightened anxiety on the EZM, possibly manifesting as the changes in maternal behavior we observed.

P197 - Does stream restoration influence the diet composition of Brindled Madtoms (*Noturus miurus*)?

Grayce Cunningham, Tom Blanchard

University of Tennessee at Martin, Martin, TN

In 2015, the West Tennessee River Basin Authority (WTRBA) completed a stream restoration project on Town Creek, a second-order, western tributary of the Lower Tennessee River. Most of the length of Town Creek has been modified to some extent and is substantially impaired by channelization and loss of an intact riparian zone due to urbanization or agricultural practices. Prior to the restoration project, the land adjacent to this section of Town Creek was devoted to agricultural activities. The project implemented a Natural Channel Design (NCD) approach to restructure the streambed such that a 1.3 km section of meandering stream channel was created and connected to the existing channel. In addition to streambed restructuring, tree planting in the riparian zone, and some streambank stabilizations were included in the restoration process. Since the completion of restoration efforts at Town Creek in 2015, changes in in-stream habitat characteristics and fish assemblage structure have been monitored at this site. However, no studies have investigated the effects of this restoration project on the ecology of any specific species of fish inhabiting this stream. The goal of this study was to determine if growth and diet composition of Brindled Madtoms (*Noturus miurus*) differed between individuals collected from the restored reach and those collected from an upstream, un-restored section of Town Creek. We used back-pack electrofishing to collect 20 madtoms from each location. In the field, individuals were euthanized and immediately placed on ice. Specimens were returned to the laboratory where otoliths were removed and stored for analysis of annuli. Stomachs were removed and preserved in 80% ethyl alcohol until contents could be removed and identified to the lowest possible taxon.

P198 - Time in Breeding Season Affects the Reproduction and Nestling Size of Eastern Bluebirds

Breelyn Grooms, Lori Cruze, Grace Schwartz

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Seasonal variation in reproduction is well documented in songbirds; however, less is known about the effects of seasonal variation on nestling size. Various factors, including food availability, increased temperatures, and natural nesting site availability have been hypothesized to contribute to the decrease in songbird reproduction during the breeding season. Eastern Bluebirds nest in tree cavities, but actively accept artificial nest boxes when natural nesting sites are limited. Here, a nest box trail was monitored at a large, urban greenspace in South Carolina to study reproductive output and success of Eastern Bluebirds and the growth of their nestlings.

Specifically, the effects of time in breeding season on clutch size, hatching success, and fledging success were studied. Additionally, we examined the effect of time in the breeding season on nestling growth. We monitored 97 nesting attempts and measured nestling mass and wing chord length on 88 nestlings throughout the breeding season. Our study showed a significant effect of time in breeding season on reproductive output and overall nestling size, with a significant decrease of both clutch size and nestling mass as the breeding season progressed.

P199 - Meiofauna Biodiversity in Ponds With Varying Levels of Exposure to Animal Waste

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Meiofauna, a hyper-diverse community of organisms measuring less than 2 mm, stands as a vital force in maintaining ecosystem health and trophic balance. Despite their pivotal role, meiofauna continue to be widely overlooked, especially within freshwater environments. Focusing on addressing this gap in Southeastern United States, our study aims to assess meiofauna biodiversity in ponds located in Cleveland, Tennessee. We specifically investigate sites with varying exposure to animal waste, proposing the hypothesis that increased exposure correlates with diminished biodiversity. Quantitative sampling was conducted across three pond sites using plankton nets. Specimens were preserved in formalin and stained with rose bengal, then taxonomically identified under light microscopes. Biodiversity metrics, including Shannon-Weiner's, Pielou's, and Simpson's indexes, were employed for quantification. The sites were as follows: Site 1, situated at a lower elevation near a farm with animal waste runoff; Site 2, a man-made pond with no apparent waste exposure; and Site 3, a pond with an undetermined exposure level. The results comprised 2,230 specimens across seven taxa. Despite variations in abundance, richness, and biodiversity indexes among sites, statistical analyses did not reveal significant differences in biodiversity (p-value > 0.5). Contrary to the initial hypothesis, heightened animal waste exposure did not correlate with reduced pond biodiversity. These unexpected findings challenge existing assumptions and emphasize the necessity for broader studies. A more extensive sample size and quantitative pollution measurements could further enhance our understanding of the effect of human activities on biodiversity. This study serves as a foundational exploration, contributing to the ongoing discussion on environmental sustainability and the potential impacts of animal waste on freshwater biodiversity.

P200 - Behavioral and Physiological Responses of Cyprinella venusta to Acoustic Signals: Implications for the Functional Significance of Acoustic Signaling in the Genus Cyprinella

Joshua Adams, Daniel Holt

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Fish communicate via various modalities, including visual, tactile, chemical, electrical, and acoustic signaling. Given the sometimes unfavorable conditions for visual and chemical communication in lotic ecosystems, sound has been adopted by a wide range of freshwater fish species. Sound production in fishes typically occurs during aggressive interactions, courtship, spawning, or foraging and conveys important information such as species identification or resource-holding potential to nearby individuals. In the genus *Cyprinella*, sounds are composed of low-frequency pulses produced either alone or in series (pulse trains). Although the association between sound types and behavioral context for *Cyprinella* has been described, few studies have investigated the functional significance of the sounds, and none have investigated interspecific responses to acoustic stimuli within *Cyprinella*. We explore the behavioral and physiological responses of C. *venusta* to unimodal playbacks of its own and of the co-occurring C. *callitaenia's* acoustic signals. We also measured auditory evoked potentials (AEPs) from C. *venusta* in response to pulse rates, mimicking calls from both C. *venusta* and C. *callitaenia* to determine whether C. *venusta's* hearing is tuned to its own pulse rate. We found that C. *venusta* showed elevated ventilation rates when exposed to both intraspecific and interspecific sounds when compared to silence, but no statistical difference in ventilation rate between signal type. We found an increase in escape behavior in response to aggressive sounds relative to non-aggressive sounds. Concerning their hearing, C. *venusta* showed less variation in latency between the onset of a pulse and the evoked potential from the brain when exposed to interspecific pulse rates relative to intraspecific rates. These findings provide insight into the functional significance and interspecific responsiveness of acoustic signaling in the genus *Cyprinella*.

P201 - Two Invading Species Affect Biodiversity in Longleaf Pine Ecosystems

Erika Rivera, Lisa Kelly, Kaitlin Campbell

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Longleaf pine savannas are biodiversity hotspots, therefore establishment by invasive Red-Imported Fire Ants (RIFA, *Solenopsis invicta*) and Asian Needle Ants (ANA, *Brachyponera chinensis*) may have a significant impact on biodiversity. The goal of our research is to survey invasive ant nests and ant diversity to identify changes in nest density, richness, and abundance over time. Surveys of RIFA nests were conducted along belt transects in 2017, 2022 and 2023 in three longleaf pine savannas. Surveys of ANA nests were conducted along belt transects in the summer of 2023. Pitfall traps were used to measure the abundance and richness of ants in 2017, 2022 and 2023. Data from 2017 showed RIFA was the most abundant ant species. In 2022 our data revealed 1) the ANA was the most abundant ant species across sites, 2) RIFA abundance and nest densities decreased, 3) there was a decrease in native ant abundance and richness, 4) and total ant abundance increased by 65% overall due to increases in ANA populations. In 2023, new methods were conducted to survey the impact of ANA in these systems and to survey the diversity of ants that may be in these habitats. These methods are: Soil samples, leaf litter samples that were hung in Berlese funnels, and a variety of bait traps. These savannas are some of the most diverse in terms of fauna and flora in North Carolina, so it is paramount to understand the impact of these invasive ants to mitigate any environmental effects of the species.

P202 - Investigating the Role of Grasses in the Formation and Expulsion of Domestic Cat (*Felis catus* L.) Hairballs

Kara Bensel, Megan Rudock, Nicole Hughes

High Point University, High Point, NC

Domestic cats (*Felis catus* L.) have been observed eating grass and plant matter as well as expelling hairballs since the beginning of their domestication. The act of "coughing up" hairballs is common among felids and canids. Plant matter, however, is costly to consume and holds no nutritional value for felids, and so the reason for its consumption remains largely unknown. Yet, many species of grasses are known to have structural features such as microscopic serrations and trichomes (leaf hairs), which could potentially act as hooks to help expel hair from the digestive tract. To test this possibility, six fresh hairballs containing grass (expelled directly following consumption) were collected from two domestic cats, air-dried, and observed under scanning electron microscopy. We also sequenced DNA from the plant matter in the hairballs to identify the plants consumed. Consistent with our hypothesis, each hairball observed featured some morphological plant structure hooking/snagging hair(s) in some fashion. Molecular identification of plant species is still underway. Regardless of the species consumed, these results have implications for the care and welfare of both domestic cats and dogs and captive felids and canids, since grass and other plants may be a necessity in animal diets that have high rates of grooming and/or are fed whole prey. Future studies could examine the role of grasses in gastrointestinal hair and/or parasite expulsion, or test whether cats and dogs choose more hooked and barbed plant material over smoother, but closely-related, species.

P203 - Comparing Arthropod Activity on Hanging Versus Ground-Level Chicken Carcasses in a Forest Environment

Abigail Young, Maddie Grace

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Forensic entomology is the multidisciplinary science of analyzing arthropod colonization of carrion as a tool for criminal investigation. The degree of arthropod colonization of animal carcasses varies across environmental conditions and the positioning of the carcass. We sought to understand how arthropod activity progresses over time on animal carcasses that vary in their position in space. The experiment was performed in November 2022 over the course of two weeks in a mixed pine and hardwood forest located on the grounds of Wesleyan College, Macon, Georgia. A total of 12 de-feathered chicken carcasses were utilized. The carcasses were divided into two categories; hanging and ground. The ground chickens were placed in metal mesh minnow traps to reduce vertebrate interference. The hanging chickens were hung from their feet using nylon rope from tree branches. Arthropod activity was recorded for five days after experiment initiation. A total of five different insect taxa were observed. Our preliminary results displayed differing insect activity on the ground versus the hanging chickens. Notably there was an absence of certain arthropods in the hanging condition that were found present on the ground chicken carcasses. These results lay a foundation for future research, while highlighting the potential need for an adjusted Post Mortem Interval (PMI) formula that could be utilized to assess hanging carcasses and their associated entomofauna.

P204 - The Influence of Weather Conditions on Incubation in Prothonotary Warblers (*Protonotaria citrea*)

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Avian embryonic development depends on a narrow temperature window provided by the parent during incubation. Weather may impact incubation duration and female behavior which may influence average nest temperature, hatching success, and female health. The objectives of this study were to analyze i) the relationship between incubation duration (days) and average daily temperatures for a 22-year dataset, ii) the relationship between daily incubation behaviors and ambient temperatures in one field season, and iii) the relationship between average nest temperature and incubation behaviors. This study assessed these objectives in Prothonotary Warblers (*Protonotaria citrea* PROW) using a long-term dataset of 1176 breeding attempts from nest-boxes along the lower James River, Virginia. Incubation behavior in 2023 was determined from changes in nest cup temperatures collected using high-resolution thermochron iButtons placed in 41 nests for a total of 127 days. This data was used to estimate daily percent time spent incubating and the number and mean duration of on- and off- bouts. Across our long-term dataset, we found that higher maximum daily temperatures and larger clutch sizes reduced incubation duration. During 2023, the percentage of time spent on the nest was highest at intermediate temperatures, and the mean duration of off-bouts increased drastically with increasing temperature. Additionally, the total number of daily on- and off-bouts decreased with increased temperatures. Older females spent a smaller proportion of time incubating with more, shorter bouts. The percent of time spent in the nest was the best predictor of average nest-cup temperatures; this behavior may therefore be the most critical for proper embryonic development. Warmer temperatures past a certain threshold may allow females to spend less time and fewer days incubating, allowing them more time for self-care.

P205 - Effectiveness of External DNA Decontamination to Evaluate Plant Diets of Aphid

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An effective method of studying the plant diets of hemipterans is to analyze their consumed DNA. Bleach decontamination is a widely used practice in the scientific community to remove external DNA contamination. Yet the effectiveness of decontamination is seldom confirmed. We hypothesized that surface decontamination involving 4% bleach effectively removes external DNA from aphids (soft-bodied hemipterans) while the consumed DNA is left undisturbed. We experimentally tested the effectiveness of two different bleach

decontamination protocols where one method used large volumes of solutions, was more time-consuming, and utilized more handling of the aphids and the other was faster, used minute volumes of solutions, and did not require handling of the aphids. We collected aphids feeding from the same milkweed plant and immediately froze them. We deliberately contaminated some aphids with strawberry DNA (juice) to mimic external contamination. These aphids were either bleached or were left as unbleached controls. Uncontaminated aphids were either bleached or left as unbleached controls. We predicted milkweed DNA would be detected in all aphids except ones contaminated with strawberry DNA and left unbleached. We predicted strawberry DNA would be detected in strawberry-contaminated, unbleached aphids. We extracted DNA from all aphids, performed PCRs using ITS2 primers, and sent amplicons for Sanger sequencing commercially. Nucleotide sequences were matched to taxa via NCBI BLAST. Unlike our prediction, we did not detect milkweed DNA in any of the aphids except control aphids that were neither contaminated nor bleached. But as predicted, we detected strawberry DNA in the strawberry-contaminated, unbleached aphids. These results suggest that both bleach protocols effectively remove external contamination. Results also indicate that 4% bleach is destroying the consumed DNA of the aphids. We aim to repeat the experiment using the rbcL gene. This study is important for understanding the effectiveness of surface decontamination of insects.

P206 - Testing DNA Recovery in Sticky Trap Insects Treated with Histo-Clear

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To investigate the plant diets of honeydew insects, we are analyzing their consumed DNA. When collecting insects with sticky traps, the surfaces of specimens can be covered in adhesive and DNA from surrounding plants. Solvents used to free trapped insects, plus any residual glue, may possibly interfere with DNA recovery. Effective and safe insect removal are required to avoid these problems. We tested two batches of aphids collected by hand from the same plants. Some insects were placed on a sticky trap, while control insects were stored in ethanol. Sections of sticky traps containing insects were soaked in Histo-Clear to remove the glue. We used 4% bleach to sterilize insect surfaces. The DNA was extracted and amplified with ITS2 primers, and then amplicons were sent to a commercial lab for Sanger sequencing. The Sanger results were inconclusive after original and repeated DNA work. Moving forward we are using two identical batches of flatid insects that were collected from separate locations to repeat the experiment without bleaching. We are using flatid insects because they are larger than aphids which makes DNA recovery easier. We will determine if using Histo-Clear to remove insects from sticky traps compromises the DNA by comparing Sanger sequencing results of Histo-Clear and control samples. This study is important for its application as a part of standardizing sample preparation methods.

P207 - Effects of Albendazole on *C. elegans* Eggs

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Over 1.5 billion people are infected with soil-transmitted helminths (STH) such as whipworm, hookworm, and Ascaris which have devastating effects on human growth, nutrition, and cognition, perpetuating the cycle of poverty. The World Health Organization only approves four anthelmintic drugs to treat STH for mass drug administration (MDA), with Albendazole being the drug of choice. Due to these drugs only having two mechanisms of action, resistance to these drugs has been reported and observed throughout the years. Previously, the effects of albendazole and other anthelmintic drugs like pyrantel, nitazoxanide, and ivermectin were tested on L4 larva of C. *elegans* and by using a health rating system it showed a health decline, confirming that C. *elegans* are a good model organism for parasitic worms (Weaver et al., 2017). We explored how anthelmintics affect *C. elegans* eggs by using hatch rates and LT50 assays with Albendazole in which their health was observed over a seven-day period. Using a health rating system, it was observed that *C. elegans* eggs were affected by Albendazole which affected hatching rates and had a general decrease in health as they hatched throughout the seven-day period. We aim to better understand STH susceptibility to drugs at each stage in their life cycle to allow us to better treat individuals. We hypothesize that if the eggs are most susceptible to drugs at this stage, grounds could be treated with drugs instead of administering MDA. This could help fight drug resistance to STH as we bring awareness to the issue and help sanitation efforts to combat this global issue.

P208 - Impact of the Invasive Plant Species *Microstegium vimineum* on Burrowing Crayfish *Cambarus monongalensis*

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I will be looking into the amount of *Microstegium vimineum* in an area and comparing it to the burrow density of *Cambarus monongalensis*. In doing this, I hope to see a correlation between the two. *M. vimineum* is a plant native to Asia that came to North America originally as packing material in 1919. Wildlife and livestock usually avoid eating *M. vimineum,* which allows the plant to grow without restraint in nonnative environments. Since *M. vimineum* grows rapidly in thick patches and is tolerant to many different conditions, it has crowded out native plant species. The dense foliage around the burrow can decrease the visibility, lessening *Cambarus monogalensis* ability to hunt for nearby prey. This study will observe the amount of *Microstegium vimineum* in a given area and compare it to the burrow density of *Cambarus monongalensis* nearby. Due to the lack of open ground space,*M. vimineum* will likely have negative impacts on the burrow densities of *C. monongalensis*. In order to complete this study, *C. monogalensis* burrows will be counted, measured and mapped out in sections of designated land with varying densities of *M. vimineum. M. vimineum* will be weighed in order to find the biomass to compare with the burrow morphometrics. This study will benefit the field by showing a correlation between invasive plant species and its impact on native fauna.

P209 - Analysis of bioluminescent blinking activity in a captive population of Split Fin Flashlight Fish (*Anomalops katoptron*)

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Flashlight fish have bioluminescent abilities that they use to communicate, attract prey, and navigate in the dark. Some species of flashlight fish exhibit a lunar-tidal rhythm in their activity patterns, in which fish are more active during dark and new moon nights, and less active during the full moon phase. The mechanisms behind this relationship are not fully understood but may be related to changes in the availability of prey and the behavior of predators during different phases of the moon. We studied a captive population of ~200 Split Fin Flashlight Fish (*Anomalops katoptron)* at the Tennessee Aquarium (Chattanooga TN) and tested whether flashlight fish change their activity through time and in relation to the lunar cycle in an environment with constant conditions, unlimited food, and an absence of predators. We expect that if this behavior is innate, we will observe alternation of high and low activity levels correlated with the moon phase, whereas if this behavior is a response to environmental cues, the correlation will be absent. Our data show large variation in the number of flashes, but this variation did not show a significant relationship with lunar cycle. We suggest future research and plan to continue collecting data to find out if the flashing activity varies cyclically or stochastically.

P210 - Assessing the Ecological Impacts of American-Chinese Chestnut Hybridization on Soil Arthropod Communities and Entomopathogenic Nematodes

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In the first half of the 20th century, a fungal blight (Cryphonectria parasitica) decimated the American chestnut (Castanea dentata) population throughout the Eastern United States. Since the 1980's, there have been ongoing efforts to create a blight-resistant hybrid using backcross breeding techniques with Chinese chestnut trees (Castanea mollissima) to reintroduce the American chestnut to its native range. To understand the ecological impacts of hybridization, we evaluated the abundance and biodiversity of soil arthropods and the presence of entomopathogenic nematodes (EPNs) in stands of chestnut trees containing either 100% American chestnuts, 94% American and 6% Chinese chestnuts, or 75% American and 25% Chinese chestnuts in Western North Carolina. Arthropods were separated from leaf litter samples using the Berlese funnel method and manually quantified and identified. EPNs collected via soil probe were extracted using the white trap method. No differences were observed in overall arthropod abundance nor EPN presence between chestnut plots. However, the unhybridized American chestnut stand had greater species dominance in comparison to the 75% American chestnut plot as well as a greater number of arachnids, insects, and myriapods than the 94% plot. Our findings suggest that while the general abundances of arthropods are unaffected by hybridization, backcross breeding may impact population composition among groups. Understanding the impacts of chestnut hybridization on soil invertebrate composition will provide context for future projects involving chestnut ecology as well as help identify potential pest species that may threaten the restoration of C. dentata.

P211 - Behavioral Plasticity in Sheet-Web Spiders

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Behavioral plasticity focuses on the changes to an organism's behavior as a result of environmental conditions. We chose to observe sheet-web spiders belonging to the family Agelenidae because they are easily collected and numerous at Piedmont University. They also have measurable and consistent web structure, consisting of a silken burrow surrounded in a sheet web. The production of silk and defined web structures is an energetically expensive behavior, and we hypothesize that changing the amount of available food will affect web phenotype. We created three treatments with different feeding regimens: a control group, a less-fed group, and a well-fed group. We measured differences in web architecture, specifically burrow depth. After collecting our data, we used a two-way analysis of variance (ANOVA). The two-way ANOVA indicated no significant difference between feeding treatments and burrow depth. Unexpectedly, the two-way ANOVA also indicated a significant difference in web-building behavior between spiders placed in newly purchased containers versus previously used boxes, indicating a potential effect of chemical residues on newly purchased plastics. Our study adds to the further understanding of contributing factors that may affect the architecture of sheet-web spiders.

P212 - Assessing the Immediate and Long-Term Effects of Neonicotinoid Pesticide Treatments on Hemlock Soil Arthropod Communities

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The hemlock woolly adelgid (*Adelges tsugae*) (HWA) is an invasive species that poses a significant threat to eastern hemlocks (*Tsuga canadensis*), leading to a decline in their populations. Neonicotinoid pesticide treatments, such as dinotefuran and imidacloprid, have been widely used to combat HWA infestations in the eastern US. Previous research has raised concerns about the environmental impact of these chemicals on surrounding animal populations, including birds and invertebrates. This study focused on assessing the effects of dinotefuran and imidacloprid treatments on soil arthropod communities in Sandy Mush Game Land (SMGL), Western North Carolina. The experiment considered different combinations of chemical control types (imidacloprid, dinotefuran, and imidacloprid) and time after application (no treatment, 5 years, and less than a year). Leaf litter samples from five plots were collected, processed using Berlese Funnels in the laboratory, and organisms were classified by order. The results indicated no significant differences in arthropod

biodiversity between plots in this experiment. While abundance variations were observed across groups, suggesting potential direct and indirect implications of neonicotinoid use immediately after treatment, the findings overall suggest that neonicotinoid use does not have long-term implications for arthropod diversity and abundance. The study recommends continued chemical treatment to prevent the ecological consequences of losing hemlock stands. We suggest future research with a larger experimental area and an extended period to explore the direct and indirect impacts of neonicotinoids on soil organism biodiversity.

P213 - Comparative effects of linalool and linalyl acetate on *Betta splendens* agonistic behaviors.

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Lavender essential oil (LEO) is distilled from the plant Lavender angustifolia and is commonly used for aromatherapy, due to its "calming" effects, but its efficacy as a mood-altering substance has not been studied in carefully controlled trials. As a distillate, LEO is not a pure compound, but is mainly composed of linalool (33.6-40.5%) and linalyl acetate (10.8-13.6%) in addition to trace amounts of lavandulyl acetate (5.3-14.1%) and linalyl propionate (5.3-14.1%). In recent years, it has been used on some fish species to test its efficacy as an anesthetic during medical procedures and as a sedative for stress inducing circumstances, such as during transport of fish to new locations, but little is known about its effects on fish behavior. Betta splendens (Betta fish) exhibit well-characterized agonistic behaviors to fight and display dominance against trespassers. Previous work in our lab indicates that treatment of Betta splendens with LEO reduced two agonistic behaviors: frontal display and caudal swing. Further studies indicated that one component of LEO, linalool, inhibited these behaviors in a dose-dependent manner. The current studies are designed to compare the efficacy of linalool and linalyl acetate on agonistic behaviors in Betta splendens. Myrcene was used in addition as a control chemical.

P215 - Improving the Captive Diet of the Lesser Madagascar Hedgehog Tenrec (*Echinops telfairi*) through Gut Loading

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The diet of the lesser Madagascar hedgehog tenrec (*Echinops telfairi*) strongly impacts individual health. Current dietary recommendations in human care are insufficient for the needs of these animals, especially if the individuals choose not to consume the entire diet. Subpar nutrition in tenrecs has been shown to lead to chronic health problems, including metabolic bone disease (MBD), hypocalcemia, and reproductive complications. Providing sufficient nutrition, specifically calcium, to tenrecs can be achieved by gut loading prey insects. Gut loaded insects deliver a complete nutritional profile to the predator while also mimicking flavor diversity found in wild insects more thoroughly than those fed a grain based diet. Gut loaded prey insects deliver substantial amounts of vital nutrients without the need for additional dietary supplementation. The increased nutritional value of gut loaded feeder insects will improve the overall health of lesser hedgehog tenrecs, reduce instances of complications like MBD, and likely bolster reproductive success. Furthermore, tenrecs in human care appear to show a direct preference for gut loaded insects, particularly when a combination of complete diet powder and powdered fruit is used. This preference for gut loaded insects over those fed a traditional grain diet will help to increase the amount of insects and, by extension, complete diet powder consumed by the tenrecs.

P216 - First dedicated survey of the Upper Guyandotte River for *Cambarus veteranus* (Guyandotte River Crayfish)

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Cambarus veteranus (Guyandotte River Crayfish) was federally listed as endangered in April of 2016. The major contributing factor for listing was the noted decline of *C. veteranus* across its range. At the time of listing, *C. veteranus* had historical occurrences in several Upper Guyandotte watershed tributaries and zero records from the Guyandotte River mainstem. In 2021 a single *C. veteranus* was collected from the Upper Guyandotte River Immediately downstream of the Pinnacle Creek/ Guyandotte River confluence. Pinnacle Creek is one of two stream systems in the Upper Guyandotte that harbors *C. veteranus* populations. Given this record, a dedicated survey of the Upper Guyandotte River is warranted. Possible methods for this survey are discussed, as well as crayfish survey methods for rivers where cambarid crayfish collection can be difficult and inefficient. The ultimate goal of this project is to determine the extent of *C. veteranus* in the Upper Guyandotte River mainstem and determine if *C. veteranus* utilizes different habitat in larger waters compared to tributaries where the species is known to occur.

P217 - Fitness Consequences of Social Organization and Social Structure in *Octodon degus*

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Animal social systems consist of four inter-related components including social organization (size of social units; SO) and social structure (non-mating interactions; SS). Few studies have considered sex-specific SO preferences due to inter-sexual fitness differences. In many group-living species, male reproduction benefits with increased multiple mating, increasing social instability and the probability of disease transfer to females and their offspring.Thus, within multi-female/multi-male social units, males can be costly to female fitness.

Across taxa, large social units enable social bonds to form, thus an interaction between SO and SS and fitness is possible. Therefore, it is possible for females to buffer against the costly fitness effects of males through increasing number of adult females (i.e. female unit size, FGS) and strong female-social cohesion (i.e. female network strength) within their social unit. I plan to examine if (1) males negatively impact female fitness and social cohesion and (2) if females are buffering against the negative effects of males by determining (i) how FGS, number of adult males per social unit (MGS), and proportion of females: males per social unit (SO) influence fitness, (2) how female social unit network strength (SS) influences fitness, and (3) the interactions between SO and SS and fitness. In Aug.-Nov. 2022-2023, social unit membership was determine by night-telemetry and trapping. Two trends suggest males are costly to female reproductive success. However, female social network strength increased with increasing number of males per social unit (r2=0.61, N=10, p=0.008), suggesting that females buffer offspring against costly males through social relationships. My study will be the first to determine specific fitness consequences two social system components. Understanding how SO and SS influence fitness is crucial for us to fully comprehend how climatic change can impact animals' social systems, reproduction, and ultimately their survival. Funded by NSF OISE 1854177.

P218 - Ecological Impact of American Chestnut Hybridization on Insect Communities

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The American Chestnut tree (*Castanea dentata*), a vital keystone species of the Appalachian Mountains faced near extinction with the introduction of blight in the early 1900s. Recent cross-hybridization with the Chinese chestnut has allowed for the development of a blight-resistant variety. The impact of this hybridization on insect communities needs to be evaluated as these hybrids are planted through restoration efforts. In the summer of 2023, we conducted a study across three plots featuring American chestnut trees with varying degrees of cross-hybridization (75%, 94%, or 100% American chestnut). We deployed insect pyramid traps, measured herbivory, and evaluated Asian Gall Wasp infestation in each of the plots. Our findings indicated that different hybrid varieties did not have a significant impact on surrounding insect diversity or herbivory on the leaves. However, the Asian gall wasp infestation was significantly different among the plots, with the 75% hybrid plot having the largest infestation and the 100% American Chestnut tree plot having the least infestation. These results suggest that cross-hybridized American Chestnut tree hybrids may not have a significant effect on the overall insect diversity or leaf defoliation, but can alter Asian gall wasp infestation levels. Understanding the effect of cross-hybridized American chestnuts on insect communities is crucial for anticipating potential pest problems and assessing possible implications for the local ecosystem.

P219 - Life History and Social Factors Influencing Social Network Structure in *Octodon degus*

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Animal social systems consist of four interrelated components: social organization, social structure, mating system, and parental care. Social structure influences the fitness of individuals, and this is evident in many species. Social structure may change due to different motivations, like mating behaviors or behaviors that contribute to parental care of offspring. I hypothesize that sexual preference influences social structure based on the life history stage of the species. During mating season, the interactions of an individual will likely be motivated by mating behaviors. During rearing season, motivation may shift to parental care behaviors. I also hypothesize that group membership and composition (social organization) influence social structure. Social interactions are expected between individuals that are familiar and/or that are closely related. In groups with non-kin, familiarity of individuals and selection for direct benefits of cooperation may facilitate affiliative interactions. In some mammals, group formation is associated with morphotypes, like the degree to which individuals were masculinized during development. The link between morphotype and social structure has not yet been described. The objective of my study is to investigate the influences of homophily according to morphotype, social organization, and life history stages on social network structure in degus (*Octodon degus*). The degu is a communally-breeding rodent endemic to central Chile. I will accomplish this by utilizing social network analysis. Network analyses involve creating networks using interaction data between individuals to infer weighted associations. Network metrics can be calculated and utilized in analyses to find connections between social network structure (SNS) and individual. The results of these analyses will be forthcoming soon. This project is significant because it will be one of the first to analyze connections between individual morphotype and social network structure. Funded by NSF OISE 1854177.

P220 - The Creation of a Body Condition Index (BCI) and its Benefits for *Heterodon nasicus*

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Heterodon nasicus, otherwise known as the Plains Hognose Snake, is native throughout central North America and is popular among multiple herpetocultural communities around the globe. Due in part to their popularity, wild populations are either at risk or actively declining as a result of poaching and habitat loss. Although they are gaining interest from multiple sectors, there is still very little information on how to accurately assess body condition. Body condition indices (BCIs) are commonly used to determine and compare visual fitness as well as fitness concerning body size for both humans and animals. Fitness refers to bodily robustness. To create a fitness model that is not fundamentally flawed, baseline data must be taken from wild populations, this is because overfeeding and improper diet are common in individuals kept in human care. Several studies have been done regarding the creation of BCIs on other popular

species, but there is either bias or lethal methodology. The resulting bias skews the data towards larger snakes. This study aims to avoid that bias by sampling in the animal's native range within the United States, including different life stages. Comparisons among several previously used BCIs are in the preliminary stages of analysis, with over 20 living in situ specimens as well as 15 ideal museum specimens being sampled already. Predictions and preliminary results, such as the baseline for weight and length interactions, show promise for both conservation and husbandry of H. nasicus and the genus of Heterodon overall. Future research could be geared towards the diversification of species analyzed as well as an official, adaptable, methodology to follow.

P221 - Exploring the Effects of Cannabidiol (CBD) Supplements on Activity Behavior in Shelter Canines (*Canis lupis familiaris*)

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Intervention strategies – including olfactory, auditory, and physical interventions - to reduce stress in shelter dogs have had varying degrees of success, but alternative approaches are needed. Oral cannabidiol (CBD) supplements are increasingly used as therapeutics to treat pain in dogs, and increasing evidence suggests that oral administration of CBD may also reduce anxiety in canines. However, additional study is needed to better understand the efficacy of these treatments in different settings, like shelters. For this project, I conducted an oral CBD intervention on 14 shelter canines at two study locations (Fredericksburg SPCA and Old Dominion Humane Society, VA). I used actigraphy to measure activity levels across a 24-hour period for five to seven days before and then five to seven days after the intervention. I measured the time animals spent resting and active during two 12-hour time periods: 6AM-6PM ("day") and 6PM-6AM ("night"). During the daytime hours, the CBD treatment did not significantly affect the dogs' time spent resting ($z=1.097$, $p=0.272$). However, there was a small (effect size: 1.23 minutes) but significant difference in the time spent active ($z=2.212$, $p=0.027$). There were no significant effects of CBD treatment on time spent resting or active during the night (p's>0.05). Additionally, we detected significant inter-individual variation in activity levels. Future analyses are needed to determine how individual- and environmental factors may influence activity in dogs living in shelters. Ultimately these findings may promote well-being for dogs living in shelters.

P222 - Determination of Thermal Husbandry Efficacy for *Hydrodynastes gigas*: Growth Rates

Brianne Light[1], Katherin Plate[1], Lauren Augustine[2], Peter DiGeronimo[2], Zachary Loughman[1]

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Historically, snake husbandry practice has been focused on perfecting effective husbandry minimums; only recently has an interest been taken in assessing how these minimums are affecting snake welfare. As ectotherms, snakes are reliant on outside heating factors to help effectively regulate all aspects of their physiology. Conductive heat, more widely known as belly heat, is a common practice utilized among the herpetological community to provide external energy, allowing the snakes to meet their thermal needs in human care. While it is known that this method grants the snakes the ability to reach preferred thermal standards, it often limits species-appropriate behaviors that basking, or heat from above, can provide. Modern herpetoculturalists have argued that providing a basking heat lamp is more conductive for snakes as it allows for species-appropriate behaviors, thereby decreasing stress and improving the overall well-being of the individual. This study will test which thermal husbandry method, conductive heat or heat via lamps, reduces stress and promotes growth for False Water Cobras (*Hydrodynastes gigas*). With a focus on providing multiple thermal husbandry types, 34 hatchling *H. gigas* will be used to test these thermal husbandry practices. Study subjects will be evenly split into two treatment groups. Treatment 1 (n=17) receiving conductive heat and an overhead basking lamp with Treatment 2 (n=17) receiving exclusively conductive heat. Thermostats are used to help maintain similar temperatures in both treatment groups throughout the duration of the study. This study intends to determine what effect thermal husbandry has on snake physiology in human care, and which thermal method results in higher species-appropriate behaviors.

P223 - License to chill: Behavioral responses of mammals to extreme temperatures

Mille Elsborg, Lisa McDonald, Emily Prince

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As climate warms, the increased frequency of extreme temperature days poses behavioral challenges to mammals. In this study, we investigated how mammal behavior changes in response to extreme hot temperatures. Specifically, we hypothesized that extreme temperatures would result in lower overall activity and a lower proportion of activity during the hottest part of the day. Additionally, we hypothesized that mammals would seek thermal refuge in forested habitats with increased canopy cover. Lastly, we anticipated greater behavioral changes for large than small animals as heat dissipation effectiveness scales inversely with animal size. To examine the effects of extreme temperatures on mammal behavior, we collected observations of mammals using motion-activated trail cameras at six sites in Upstate South Carolina. At each site, three to six cameras were placed in habitats classified as forest, edge, or open. For each observation, we recorded the species present and time of day. We classified each species as either small, medium, or large based on their weight. Extreme temperature days were defined as those having a maximum temperature in the highest 10% of temperatures recorded duringall days at that site. We compared habitat, time of activity, and overall activity levels between extreme temperature days and other days for all mammals and for each size category. As hypothesized, mammals were less active overall on extreme temperature days. However, they did not avoid the hottest part of the day. Further, only small mammals used forests as a thermal refuge on hot days. In conclusion, results suggest that mammals do change behavior in response to extreme temperatures. However, the need for heat dissipation does not seem to be of more importance than other characteristics such as diel activity patterns and habitat choice as a predictor of mammal responses to extreme temperatures.

P224 - Determining dietary niche overlap of two woodland salamanders using stable isotopes in Great Smoky Mountains National Park

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Plethodon salamanders have been identified as ideal model organisms for ecological and evolutionary research. These amphibians are typically abundant where found and play vital roles in their ecosystems. Southern Zigzag salamanders, *Plethodon ventralis*, and Southern Redback salamanders, *Plethodon serratus*, are two small-bodied woodland salamanders that potentially overlap in the Great Smoky Mountains National Park and the surrounding area. These two species are ecologically similar but research is lacking to explain how they coexist. Resource partitioning is often thought to contribute to species coexistence. Sympatric and allopatric populations of the two salamander species will be studied to determine if niche overlap exists in isotopic diet. Tail tissues approximately 5mm in length were collected and processed for stable isotope analysis since previous work showed ample information can be gathered from these tissues rather than sacrificing the animal. Sympatric and allopatric populations were sampled to determine isotopic diet of individuals from eighteen sites. Based on preliminary results, it appears there is overlap in the dietary niche space of *P. ventralis* and *P. serratus*. Environmental parameters may play a bigger role in the coexistence of the two woodland salamanders in question. This research will expand our understanding on what factors may enable coexistence of ecologically similar species.

P225 - The Dawn Chorus in the Georgia Piedmont in Relation to Environmental Variables

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The goal of this study was to determine relationships between the dawn chorus of Georgia bird species and environmental factors such as precipitation, temperature, cloud cover, lunar phase, and the timing of sunrise. A Wildlife Acoustics songmeter SM4 autonomous recording unit was placed at Piedmont National Wildlife Refuge to record bird song each morning from April to June, 2021. Audacity software was used to visualize sonograms and determine the timing of the first song each morning for the Pine Warbler (PIWA), Common Yellowthroat (COYE), Bachman's Sparrow (BACS), Chipping Sparrow (CHSP), Northern Cardinal (NOCA), Wood Thrush (WOTH), and Indigo Bunting (INBU). Information regarding environmental factors was retrieved from timeanddate.com and local weather archives. As expected, the time of first song became earlier for all bird species as spring progressed and sunrise occurred earlier. The relationship between morning temperature and the number of minutes before civil twilight that first song occurred was determined with linear regression. INBU, CHSP, BASP, COYE, and PIWA all sang earlier on cold mornings, while NOCA and WOTH showed no correlation. There was a consistent pattern across bird species: NOCA began the dawn chorus at 27 minutes before civil twilight (CT), and PIWA sang after all the others had begun (4 minutes before CT). Correlations between the onset of dawn chorus versus precipitation and percent moon illumination will also be discussed. Both extrinsic abiotic factors (e.g., precipitation, temperature) and intrinsic factors (e.g., body mass, residency status) may influence when morning singing begins for each species. For example, the acoustic transmission hypothesis proposes that the greater density of cold air enhances the distance that bird song travels. It is important to research the effects that environmental factors have on the behavior of bird species in an age when the environment is changing more rapidly than ever before.

P226 - Environmental covariates associated with Plains Hognose Snake (*Heterodon nasicus*) surface activity in a prairies habitat

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Members of the Series Reptilia, a taxa of ectothermic vertebrates, rely on their environment and its factors to function. Because of this, these individuals are more likely to follow a set activity pattern based on environmental factors, increasing the predictability of where they will be found under given conditions. Those interested in finding reptiles in their natural habitat, whether professionally or as a hobby, would be aided by knowledge of a species' preferences for habitat and environmental factors. The principal benefit of this knowledge would be increased efficiency in the collection of target taxa for research. The Plains Hognose snake (*Heterodon nasicus)*, a semi-fossorial snake in the family Dipsadidae, is one such taxa. These snakes are located in the mid-western portion of the United States and are known to be highly secretive and difficult to find because of their fossorial behavior. Using *H. nasicus* data collected from a localized region, a statistical analysis of environmental conditions can be run to determine favorable environmental factors that will increase the probability of locating members of this species. Additionally, the herpetoculture industry could greatly benefit from this information, making it significantly easier to accurately represent the environmental conditions that an individual would experience in the wild.

P227 - Feeder Visitation by a Wintering *Selasphorus* Hummingbird in Relation to Temperature and Day Length in Georgia

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The feeding activity of a Selasphorus hummingbird (cf. Rufous Hummingbird, S. rufus) was documented at a nectar feeder in Macon, Georgia to test whether visitation was correlated with ambient temperatures and seasonal patterns of day length. Images taken by an Akaso game camera every 30 seconds were used to track the time of visitation, which was monitored from about 20 minutes before

sunrise to 20 minutes after sunset (e.g., 7:15 AM to 5:59 PM on Jan 3, 2023). The camera took about 1,300 pictures each day for two months (December 20, 2022 – Feb 26, 2023), until the hummingbird departed. From the resulting 81,421 photos, the time of the first and last visits of the day were recorded, as well as the total number of feeder visits per day. Temperature and the time of sunrise and sunset were compared with the frequency and the timing of visitation by the hummingbird. The hummingbird was more frequent early in the morning when temperatures were low, suggesting that the bird compensated for the extreme temperatures by emerging earlier and feeding more often after its period of nighttime torpor. Rufous and other Selasphorus hummingbirds enter torpor--a period of lower metabolic rates--at night as an energy-conserving mechanism. This study demonstrates that game cameras are useful tools for the study of animal behavior, in this case to document the foraging rates and timing of morning feeding by a rare overwintering hummingbird.

P228 - Effects of hydrologic variability on the development of *Lithobates sphenocephalus*

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Organisms use environmental cues to make phenotypic changes that maximize fitness. As humans manipulate the environment, environmental variation can become so extreme that it exceeds the range of conditions from which the organism can respond effectively. As humans affect climate and modify rivers, hydrologic conditions become increasingly variable. Organisms, like anurans, that require water for their early life stages seek to maximize size at metamorphosis while facing the risks of predation, competition, and pond drying. This study investigates the impact of hydroperiod variation on the survival and development of Southern Leopard Frogs (*Lithobates sphenocephalus*) in *ex-situ* pond mesocosms. We manipulated mesocosm water levels to simulate different rates of pond volume fluctuations and examined their impact on tadpole survival, time to metamorphosis, and morphology. We did not find an effect of hydrologic variability on larval development, survival, time to metamorphosis, or morphology. Anurans may not be able to respond to habitat variability that occurs at temporal scales of days to weeks as in this study, or their response to environmental fluctuations may be conditional on additional factors. Alternatively, our treatments with low water levels may not have changed the benthic area or resource availability and, thus, may have had little impact on growth. This work emphasizes the complexities of frog responses to hydrologic variability and the importance of considering several interacting elements when measuring phenotypic plasticity in changing contexts.

P229 - Snakes are where you... don't find them

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Ratsnakes in the genus Pantherophis are common and abundant throughout much of eastern North America. They are very frequently found in and around man-made structures in urban and rural settings alike. Perhaps owing to our resultant familiarity with them, there have been surprisingly few published radio-telemetric studies of this taxon, most of which were conducted in the northern reaches of their range. In August 2024 we began investigating site use by a single transmitter-implanted Eastern Ratsnake (P. alleghaniensis) in the South Carolina piedmont. The subject's partial-year home range (100% MCP) thus far is 5.8 ha. Of 31 relocations, the subject has been visible only four times. Almost all other times, it has been well hidden in natural refugia with visible entrances that most observers might think look like a place one would find a snake but most often do not. Though these snakes are noted for their arboreality, this individual has been relocated much more frequently (and at many more sites) underground than on or inside of standing trees/cavities.

P230 - How does a global climate cycle affect the reproductive output of a neotropical migratory bird?

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El-Niño Southern Oscillation (ENSO) causes regional changes in temperature and precipitation, and has been found to have varying effects on the survival, fecundity, and recruitment of migratory songbirds. This study seeks to better understand the effect of ENSO on the fecundity of Virginia-breeding Prothonotary warbler (*Protonotaria citrea;* PROW), a nearctic-neotropical migratory songbird. PROW breed in the Eastern United States and spend the non-breeding season primarily in Panama and Colombia. Ongoing research has found a positive relationship between spring precipitation and predicted number of PROW fledgelings during La Niña, but a negative relationship between spring precipitation and predicted number of fledgelings during El Niño. To better understand this relationship, and whether the negative impact of El Niño on breeding might be due to conditions on the non-breeding grounds, two questions were addressed using public data from NOAA and the rsoi package on RStudio:

1. How does ENSO affect the vegetation health index (VHI), vegetation condition index (VCI), precipitation anomalies, and temperature anomalies in Virginia, the breeding grounds of PROW?

2. How does ENSO affect vegetation health in Panama and Colombia, the wintering grounds of PROW?

I tested for relationships using linear models, and found that ENSO had little impact on temperature and precipitation anomalies as well as vegetation health in Virginia, regardless of season. However, in both Panama and Colombia, the mean monthly VCI and VHI were significantly lower during El Niño during the months when PROW were overwintering there. This indicates that differences in fecundity during the breeding season may be the result of carryover effects from very dry El Niño conditions in overwintering habitats. These results are especially concerning due to predictions for increased intensity of El Niño events caused by climate change.

P231 - Naturalistic Enclosure Design impact on Crested Gecko (*Correlophus ciliatus*) Behavior

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Historically, reptile husbandry practices have been based on anecdotal evidence. Recent advancements in Herpetoculture have shifted captive care towards evidence-based husbandry practices. Evidence-based husbandry combines the animal's natural history and current husbandry protocols to better replicate their natural environment. This natural history One species commonly found in Herpetoculture circles is the Crested Gecko (*Correlophus ciliatus*). Knowledge of their activity and behaviors in the wild are not well researched, possibly leading to negative welfare implications to those housed in human care. *C. ciliatus* is native to New Caledonia's Isle de Pines, within tropical rainforests. The purpose of this study is to compare traditional, minimalistic housing practices to those created with knowledge of evidence-based Herpetoculture. Three bioactive vivariums were built using this methodology. A behavioral ethogram was completed on three *C. ciliatus* in their traditional enclosures before moving the geckos to their naturalistic vivariums, where a second ethogram was conducted. This study finds that providing a more naturalistic and larger environment increases activity levels of *C. ciliatus* in captivity and increases the use of cover during resting periods. Anecdotally, keepers have experienced a decrease in defensive behavior from some geckos. Further research is needed to validate the findings in this study.

P232 - Characterizing water fluxes in a bottomland hardwood forest and discerning the primary drivers influencing these fluxes

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Evapotranspiration (ET) plays a pivotal role in the water budget of Bottomland Hardwood Forests (BHF), influenced by an intricate interplay of meteorological variables. Eddy covariance water and heat flux data obtained from 2013 to 2018 collected at the US-ULM flux tower (37.30m) were used to characterize diurnal, seasonal, and inter-annual fluxes. We used a structural equation modeling approach to dissect the drivers of ET across varying timescales and seasons. The latent heat flux exhibited a distinct diurnal pattern from March to September, peaking at 146 w/m2 around solar noon. Notably, latent heat (LE) flux surpassed sensible heat (H) flux during late spring and summer, showcasing values of 127 w/m2 and 145 w/m2, respectively. In contrast, H flux (36 w/m2) exceeded LE flux (28 w/m2) during winter-spring transitions when temperature fluctuations were maximal (-5 to 20°C). Daily ET values ranged from 0.52 mm/day in winter to 5.2 mm/day in summer. Factor analysis unveiled shared variance among drivers, while path analysis quantified individual drivers' independent contributions. Results highlighted the coherence between ET and net radiation (Rn) variability, particularly with Vapor Pressure Deficit (VPD) and temperature during Spring, Summer, and Autumn. However, Winter exhibited disparate patterns. Path analysis underscored Rn as the primary driver of ET variations through direct and indirect pathways. Windspeed and precipitation made significant, albeit smaller, contributions to ET variability. Overall, an average daily ET of 3.4 mm/day was predominantly driven by net radiation across all seasons. The study suggests that in deciduous forests like BHFs, ET is primarily energy-dependent during the growing season and early non-growing season, transitioning to temperature-dependence after leaf senescence in winter

P233 - The Impact of Habitat on Terrestrial Niche Partitioning Between Amphibians

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Studying how different organisms niche partition within an ecosystem remains an important aspect for the field of ecology. Studying how different species of amphibian ecologically interact remains important due to their importance as bioindicators.. We wanted to determine the presence of significant niche partitioning between different species of amphibian foraging in terrestrial environments. Comparisons were made between *Eurycea cirrigera* and *Plethodon cinereus.* We investigated similar differences between unstriped and striped morphs of *P. cinereus* to determine the possibility of these being distinct ecotypes. We hypothesized that *E. cirrigera* may be displaced from areas with greater temperature and less humidity present due to requiring aquatic environments for reproduction. We also hypothesized that unstriped *P. cinereus* may be displaced within habitat with greater temperature and lower humidity present due to lower basal metabolic rates. Habitat characteristics were quantified using atmospheric temperature, atmospheric humidity, soil moisture, soil temperature, soil pH, distance to stream, etc. We were able to make some preliminary observations on mean values despite statistical analysis not being performed. For example, we found that mean values indicated *E. cirrigera* may have been more common within colder and wetter environments when compared to *P. cinereus.* Mean values may indicate unstriped *P. cinereus* was more commonly found in areas with greater humidity present and decreased temperatures. We plan to do more rigorous statistical analysis to determine whether this data is significant once more data is collected from our study sites. This data may provide evidence for unstriped and striped morphs of *P. cinereus* being different ecotypes along with evidence supporting niche partitioning between different species of amphibian.

P234 - Patterns of diazotroph diversity in nodulating plants of the Southeastern USA

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Nitrogen-fixing symbioses, particularly in root nodules, represent one of the most significant symbioses in natural and agricultural systems and a globally important source of bioavailable nitrogen. The containment of nitrogen-fixing bacteria in root nodules occurs exclusively in the so-called nitrogen-fixing clade, a group of four orders of flowering plants (~31,000 species), in which ten families have members capable of engaging in this symbiosis with either proteobacteria or actinobacteria. Despite the long-running interest in nodulation, the composition and diversity patterns of nitrogen-fixing symbionts are poorly understood in natural systems, with conflicting hypotheses on geographical and phylogenetic constraints to symbiotic match-up and function that have not been fully explored. Here, using a broad survey of nodulating plant taxa across the southeastern US, we investigated patterns of diversity and composition of diazotroph genera to assess whether overall diazotroph diversity is defined primarily by geography, host identity, or phylogeny. To this end, we sampled 96 species of nodulating plants from 68 sites in Mississippi, Alabama, and Florida. For each plant specimen, four different samples were prepared: soil at the site, the soil directly attached to roots (rhizosphere), roots without nodules, and nodules. DNA was extracted from each sample, and the V4 region of bacterial 16S ribosomal DNA and fungal ITS1 were amplified for amplicon sequencing on an Illumina MiSeq instrument. OTU calling and community diversity metrics were calculated in QIIME2. The relative frequency of bacterial classes and genera varies significantly across the different sampling levels. We also found that Faith's phylogenetic diversity of diazotrophic communities varied significantly across the 18 different legume tribes and host habitats we sampled; legume tribes also differed in terms of most prevalent diazotroph symbiont. Our results suggest that host phylogeny and habitat play a significant role in the structuring of diazotrophic communities in natural habitats.

P235 - Dispersion patterns and mortality rates associated with wildlife-vehicle collisions involving Eastern Newts (*Notophthalmus viridescens*) in Virginia's Cumberland Mountains

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Wildlife-vehicle collisions (WVCs) are a growing source of mortality for amphibians, leading in extreme cases to population declines and localized extirpations. Eastern Newts (Notophthalmus viridescens) are especially abundant in national forests and parks in central Appalachia – an area with increasing visitation for tourism and outdoor recreation – with their alternating terrestrial and aquatic life histories making them important contributors to ecosystem function. Terrestrial eft stages frequently place newts along roadways, heightening concerns about newt mortality from WVCs. We examined spatiotemporal patterns of newt mortality rates along a popular paved driving route on High Knob, Virginia, a 4,200-foot summit in the Jefferson National Forest. We specifically examined mortality rates across a three-month period in the fall of 2023, recording WVC date along with the newt life stage, geographic location, distance from shoulder of the road, road type, and canopy cover associated with WVCs. We then examined dispersion of newt WVCs and compared weekly mortality rates prior to and following a decrease in traffic activity following the seasonal closure of a popular recreation area. Newt WVCs (518 total) were clustered around artificial wetlands constructed near the roadway as wildlife habitat, with weekly mortality rates significantly decreasing along a road segment leading to a popular recreation area after that recreation area's seasonal closure. However, this decrease coincided with a shift to seasonal newt overwintering patterns. Mortality rates also showed rapid and brief increases during special tourism events causing increased local traffic rates (road races, auto touring, and outdoor education events). Our data highlight the need for targeted conservation measures for amphibian populations that take local-scale habitat, animal dispersion patterns, and seasonal traffic rates into account to minimize and mitigate WVCs.

P236 - A Comparison of Plant Communities on Adjacent Northwest- and Southeast-Facing Slopes on Grandfather Mountain in Western North Carolina

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Aspect exerts large effects on plant communities because of differences in solar radiation and consequent temperature patterns. South-facing slopes have higher solar radiation inputs in summer, creating greater evaporative demand and drier soils than on north-facing slopes, which results in distinctly different plant communities. Less well studied are differences in community composition between east and west-facing slopes. East-facing slopes receive high radiation inputs in the morning, whereas west-facing slopes are exposed later in the day. Such differences would primarily affect plants in the herbaceous layer, since earlier morning radiation on east-facing slopes would raise soil temperatures and stimulate emergence earlier in the day and season compared to that on west-facing slopes. We undertook a study on Grandfather Mountain, an isolated southern Appalachian peak that runs northwest/southeast to determine if plant communities differed between adjacent northwest and southeast-facing slopes. We set up four 20x20 m plots on each slope, 30-40 m below the ridge, in adjacent mixed hardwood forests with two 1x1 m subplots/plot for understory plants. Tree species composition and diversity were similar (Sorensen Index = 0.67; Shannon Diversity = 1.86 on both slopes), but the southeastern slope had higher stem density (1400 vs 694 per ha). The herbaceous layer was more diverse and had greater percent cover on the northwestern slope. Tree community composition, other than density, did not differ by slope, perhaps because they grow taller and are less impacted by aspect. However, as hypothesized, slope aspect was important for understory communities, which may be more affected by differences in early morning and afternoon light. An ephemeral stream on the western slope and competition from a denser southeastern overstory may also have affected herbaceous communities. Aspect may interact with future climatic warming impacts by differentially affecting phenology and growth of herbaceous species on these two slope aspects.

P237 - The Effects of Female Prebreeding Feeding Frequency on Egg and Hatchling Morphometrics in *Lampropeltis* (Kingsnake) species.

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The genus *Lampropeltis,* including all New World kingsnakes, contains multiple subspecies found throughout the United States, with a large amount of range overlap. Multiple *Lampropeltis spp.* are considered stable and there is an adequate understanding of their biology; therefore *L. getula,* specifically, can be utilized as a model species in studies for similarly related species of conservation concern. *Lampropeltis getula floridana* (Florida Kingsnakes), *Lampropeltis getula getula* (Eastern kingsnakes), *and Lampropeltis getula meansi (Apalachicola kingsnakes) were all included in this research. Females separated into the control group were fed once per week, while the experimental group fed twice weekly, from the end of brumation until oviposition was complete. Upon laying, measurements of mass, length, and two width measurements per egg were recorded. The eggs incubated at 26.7 degrees Celsius for approximately 60 days. After hatching, neonates underwent measurements of mass, head length/width, body width, tail length, full body length, and snout to vent length.* Results revealed no statistical significance in most morphological comparisons; however, both hatchling head length and egg number showed a statistical significance. Despite the experimental group containing individuals with larger relative clutch masses, there was no statistical significance when running an unpaired t-test. The largest relative clutch mass was within the experimental group being 276.6 grams and the smallest within the control group, weighing in at 0.3 grams. Overall, the outcomes found through this study aim to provide a knowledgeable food intake adjustment protocol, resulting in larger eggs and larger hatchlings that can be utilized in species in need of reintroduction conservation assistance. Future research will take place during the 2024 breeding season and will include new additional breeding pairs as well as reverse feeding frequencies from the 2023 breeding season, providing knowledge regarding neonate fitness being dependent on female anatomy and physiology.

P238 - Weekly Floral Survey of Collins Gulf in Savage Gulf State Park (Spring 2023): A Learning Process

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Weekly, between February 2 and June 12, 2023 (17 weeks), we attempted to identify most flowering plants, including a few trees, and document their developmental stage and relative abundance. We classified developmental stages as emerging, leafing, flowering, fruiting, and senescent and documented the timing of each stage for all species observed. The relative abundance of each species was estimated as 1, 10, 100, or more than 1000 individuals of each species. One hundred and fifty-seven species were identified over the course of the study. Twenty species were rare, and less than ten individuals were observed. Of these, 20 species were considered rare (less than ten individuals observed), and 13 of these were identified in only one zone. Twenty-one species were abundant, estimated to be represented by more than 1000 individuals each at some point in the study. The trail was divided into five consecutive zones differing in their environmental milieu. We recorded the date of the first observation of each species within each zone. We observed that the dates of developmental stages in some species were highly synchronous while others were not. As expected, developmental stages of some species appeared for only a day or two while others were longer lasting. Of the 157 species we identified, 38 were limited to one of the zones, and 13 were observed in all five zones. We note, of particular importance, that three times as many species have restricted ranges in this study compared to those found ubiquitously.

P239 - Behavioral Comparisons Between *Hydrodynastes gigas* Supplied With Different Heating Sources

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All reptiles need external heat to thermoregulate, allowing the body to perform a variety of critical life functions. Reptiles can be observed performing species-specific basking behaviors under heat sources such as the sun. This study is being conducted to see if there is a significant difference in behavior between two groups of juvenile False Water Cobras (Hydrodynastes gigas) provided with different heat sources. Thirty-four H. gigas, housed individually in identical enclosures, have been divided into two even groups, with each group receiving a different source of heat. Group 1 receives ventral heat via heat pad and dorsal heat via overhead heating element and Group 2 receives ventral heat via heat pad only. Observational images were taken daily in three hour intervals, from 8:00 to 17:00 to see what behaviors, physical positions and thermal positions the study subjects were displaying. After performing preliminary statistical calculations, it has been determined there is a significant difference between the two heat sources during certain times of the day. If the previous trends continue throughout this study, then it is expected that these statistical differences will cement the idea of a possible preference in heat source based on behaviors observed. Additional research related to this project might include growth and behavioral comparisons over extended periods of time as well as stress levels during the study.

P240 - Novel Technique for Determining Burrow Dwelling Spiders Community Structure

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Antrodiaetus unicolor is a trapdoor spider species endemic to the eastern U.S., specifically the central and southern Appalachian regions. Fringe populations are found as far west as the Ozarks and down south as far as the Gulf coast. Characteristically, *A. unicolor* excavate burrows are lined with silk that are hidden by collapsible or foldable "doors". The doors are made of a combination of silk, soil, and dead plant material. Burrow aggregations are found in cool, humid, and loamy soils in densely forested areas. Burrows are often located on inclined surfaces such as ravines, stream banks, roadsides, and hiking trails. Despite the broad distribution of *A. unicolor*, there have been no extensive formal studies on the ecology of *A. unicolor*. The aim of this study was to develop a methodology for determining the community structure and organization of *A. unicolor* burrow clusters as found in the spiders natural habitat. Knowledge of *A. unicolor* cluster morphology is limited and reliant on anecdotal observations, therefore developing a standard methodology for defining burrow arrangement is a beneficial step forward for understanding the dynamics or *A. unicolor*. These methods may also be expanded to other mygalomorph spiders.

P241 - Abiotic factors influencing *Morella cerifera* seedling establishment in barrier island grassland swales

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Shrub encroachment into grasslands is occurring along the mid-Atlantic and Gulf coasts by the native, evergreen shrub, *Morella cerifera*. Previous studies on Hog Island, Virginia, a long-term ecological field site, show dunes >2 m elevation protect *M. cerifera* during early stages of development; however, the conditions that make this a favorable location for seedling establishment are unclear. In this field study, multiple abiotic factors (i.e., soil moisture, temperature, and grain size), were quantified in swales behind dunes of varying elevations (>2m, 1.5m, and 1m) to determine how they may contribute to successful seedling establishment. Soil moisture was low in this coastal environment, but significantly lower behind 1 m dunes (2.3% ± 1.1). There were no differences in soil moisture behind the >2m and 1.5 m dunes. Similar results were found with temperature: swales behind 1 m dunes experienced warmer minimum (20.7°C ± 0.1) and maximum (37.3°C ± 0.3) temperatures and there were no significant differences between swales behind 1.5 and >2 m dunes. Grain size did not differ among the three grassland swale locations. The microenvironment behind 1 m dues is drier and warmer, likely limiting successful establishment of shrubs. However; it remains unclear why *M. cerifera* does not naturally establish behind the 1.5 m dune as similar abiotic conditions occur as in swales behind >2m dunes. Future studies will examine the role of biotic interactions that may influence successful seedling establishment in these swales.

P242 - Promoting Microbial-Based Methods in Invasive Plant Management

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Invasive plant species pose a significant global challenge, resulting in substantial economic losses. It is imperative to explore microbial-based approaches for managing invasive plants, aiming to ultimately diminish their fitness. This study delves into the underutilized potential of harnessing plant-microbe interactions and inter-microbial relationships as tools for invasive plant control. While this method is in its early stages, we firmly advocate for the prioritization of integrating microbial components into management techniques, as it shows great promise in expanding sustainable invasive plant control. Combining specific microbes with complementary or synergistic traits may enhance the competitive edge of native plants and increase the vulnerability of invasive species, potentially reducing their overall fitness in the invaded ecosystem. It is crucial not only to evaluate the effectiveness of individual microbes for invasive plant management but also to examine the interplay, strength, and directionality of interactions between different taxa in microbial consortia. These strategies should be integrated into invasive plant management programs. We strongly urge the invasive plant management research community to incorporate microbial dynamics into their exploration of control strategies. Although these methods hold substantial control potential, further research is essential to transition them into active development.

P243 - Floral Phenology and Species Distributions in the Southern Appalachians

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As climate change progresses, the phenological distribution of living organisms is likely to shift in response to shifts in season length, temperature, precipitation, and other climate change-related impacts. For regional flora, documenting baseline species distributions and phenologies will be critical for assessing change as the climate shifts. The aim of this project was to document the distribution and phenologies of floral species along the Blue Ridge Parkway of the Southern Appalachians (BRP), the longest linear national park in the US. We conducted a photographic inventory of the biodiversity of flowering species on the Blue Ridge Parkway in 2022-23, throughout the growing season. We used iNaturalist to collect identification data and the location of species along the BRP with the help of citizen scientists and students. We will also develop species distribution models in R and ArcGIS to evaluate current and future distribution responses to new climates brought on by climate change. Understanding the past, present, and future of flowering plants' phenologies and distribution is essential to understanding how ecosystems will shift as climate continues to do so. Pollinators depend on floral resources with greater reliance on early and late flowering species therefore a model predicting the future of the floral community is useful for studying the future of pollinators. This survey was conducted to aid in studying plant-pollinator interactions in Southern Appalachia due to increased interest as pollinator declines have been documented worldwide.

P244 - Interactions Between Fungal Endophytes and Pathogens Isolated from the Invasive Plant Kudzu (*Pueraria montana* var. *lobata*)

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In this study, we explored the interactions between fungal endophytes and pathogens extracted from the invasive plant, Kudzu *(Pueraria montana* var. lobata) in a controlled in vitro environment. Our goal was to determine whether endophytes had the potential to impact the growth of these pathogens. This investigation represents a pivotal initial step in the development of potential fungal inoculants that could aid in suppressing kudzu. While most of our endophyte-pathogen experiments pointed towards antagonism or competitive interactions, we did identify specific combinations of pathogens and endophytes that indicated potential facilitation of the pathogen's growth. Further research is needed to ascertain if these interactions might have effects on phytopathogenicity within a live plant environment. This study underscores the potential of fungal endophytes as a promising ecological approach to managing invasive plants through pathogen facilitation.

P245 - The DRIVES Project, a network of long-term agricultural experiments to determine how Diverse Rotations Improve Valuable Ecosystem Services

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The DRIVES Project (Diverse Rotations Improve Valuable Ecosystem Services) organizes legacy data from 21 long-term field experiments throughout North America to address research questions about the multifunctionality of agriculture. The DRIVES Project has developed a community of researchers who manage long-term experiments and has created expertise in organizing legacy data across multiple sites, which have great value for future synthesis studies. The database will be publicly available so that other researchers can explore their own questions of interest, thus amplifying the body of research on slow-changing variables (e.g. soil properties) and management practices that take multiple years to have an effect. The DRIVES Project connects experiments that include crop rotations as part of their treatments to robustly quantify the role of rotational diversity on cropping system performance and resilience under adverse conditions. Two sites, initiated in 2002, are in Milan and Spring Hill, TN and compare cropping sequences of corn, soybean, and/or cotton (Milan only) managed with cover crops, poultry litter, or fallow as fertilizer inputs. Our poster will provide background on the DRIVES Project and research results on system output and weather, with a focus on how results from Tennessee compare to other regions. Better understanding conditions in which rotational complexity can be leveraged to improve system productivity will help scientists design improved cropping system strategies and producers choose more sustainable agroecosystems.

P246 - An Assessment of an Aquatic Turtle Community in Urban Wetlands

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The purpose of this study was to describe the community ecology of an aquatic turtle assemblage at an urban wetland site in Dalton, Georgia. Studies have shown that urban development affects the diversity and ecology of long-lived animals, like turtles. Multi-year sampling efforts are required to reveal the long-term effects of civil encroachment on associated turtle communities. Trapping efforts were carried out during sampling periods from 2021-2023 at the wetland site. Turtles were collected using individual hoop nets and fyke arrays. Specimens were identified, sexed, marked, measured, and released on site. Ecological metrics, including sex ratios, sexual dimorphisms, and relative abundance were determined. Eight species of turtles, representing four families, were detected, with Emydids *Trachemys scripta* and *Chrysemys picta* being the most abundant. During the 2023 catch per unit effort for *T. scripta* was over six times higher than any other species. Sex ratios approached a 1:1 ratio for most of the encountered species. Sexual size dimorphisms for *T. scripta* were significant and similar to those observed in other populations.

P247 - Exploring Ecological Symphonies: Unraveling Shifts in Phenophases of Trees vis-à-vis Changing Temperatures

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Temperature serves as the primary driver for plant development, influencing the timely progression of ontogenetic stages. In temperate deciduous forests, the dormancy periods necessitate meeting a chill requirement for optimal growth during the subsequent season; failure to do so introduces stress and shifts in phenophases. Elevated temperatures earlier in the season expedite plant growth, leading to earlier budbursts. We used a total of eight years' worth of hourly images of the canopy, alongside high-frequency temperature data collected at the US-ULM Flux tower, at Russell Sage WMA, northeast Louisiana. Green chromatic coordinate (GCC) index derived from PhenoCam imagery was used in the analysis along with temperature data. Temperature was measured at 5 different heights, two readings were taken below the canopy (4m and 12m), two were at the canopy (22m and 27m), and one was above the canopy (37m). Results revealed a significant shift in GCC-rising, between 14 March 2014, and 25 February in 2023, signifying an average 17 days

advancement in budburst. Similar trends were observed in GCC-falling between November 13, 2014, and November 19, 2023. Notably, the advancement of budburst corroborates rising temperature trends for these years. The average temperature for the 7 days preceding 14 March 2014, was 9.86 °C, and for 14 March 2023, was 15.01 °C, a difference of 5.15°C. The mean temperature during the week of 25 February 2014, was 10.47°C, and 25 February, 2023, was 19.89°C. The observed difference of 9.42°C between those months was over a 9-year period. Emphasizing the potential for climate-driven leaf phenology and growth models; our findings suggest that such models may enhance predictions of forest stress and by extension the state of gross primary productivity. This research sheds light on the intricate relationship between temperature, phenological shifts, and forest ecosystem dynamics, contributing valuable insights for ecological forecasting and management.

P248 - Using stable isotope analysis to determine the basal carbon and trophic position of organisms in the St. Johns River, Florida

Cara Addison

Jacksonville University, Jacksonville, FL

The St. Johns River is an essential habitat for many organisms. As an estuary, this ecosystem provides food and shelter to both resident and migratory fish. Most of these fish are both recreationally and commercially important, increasing the need for understanding their habitat. Currently, there has been very little research conducted on the function of this system, making further research necessary. For this study, stable carbon and nitrogen isotopes will be used to determine the basal carbon sources and trophic pathways of 10 commercially important organisms in the St. Johns River, Florida. Carbon isotopes are natural markers that can be used to follow energy pathways in an ecosystem. Identifying the basal carbon source(s) allows us to determine which areas are supplying energy to the system. Trophic webs provide important information regarding function and stability of a system. Nitrogen stable isotopes can be used to dictate trophic position since it predictably increases between consumers by an average of 3.4‰ (Gu et al. 1996, Bearhop et al. 2004). To assess these ecological factors, muscle tissue from seven species of fish, one species of crab and one species of shrimp will be collected quarterly: September 2023, December 2023, March 2024, and June 2024. Plankton tows will be conducted one month prior to fish collection and plant and sediment samples will also be collected for analysis. Results from this study will provide a better understanding of how carbon moves through this system and the relationships between the target organisms. This information will be a baseline that we can use to predict how the river may be affected by anthropogenic impacts such as climate change. Overall, the data gathered from this study will provide new and vital information, benefiting both the ecosystem and the local economy that relies on the St. Johns River.

P249 - Evaluation of fish assemblages in Black Warrior and Cahaba river headwaters in Birmingham Alabama.

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Birmingham Southern College, Birmingham, AL

The industrialization of Birmingham Alabama in the 1800s following the discovery and mining of limestone, coal, and iron ore for the production of steel is well documented. Changes in native flora and fauna in response to impact from those activities likely occurred in those early, frontiersman days and continue to present day. Floral species loss is evident as ecologists began conducting surveys in the 1800s. However for fishes the earliest extensive surveys began in the 1950s. We used EPA Rapid Bioassessment Protocols (RBPs) to examine fish assemblages in several headwater streams (Village creek, Five-Mile creek, Beaver creek, Turkey creek, Black creek, and the Little Cahaba river) in the NE corridor of Birmingham to assess current status in comparison to historical fish assemblage data. These streams are found in the heart of the city (Village creek) and extend about 20 mi. NE into rapidly gentrifying, suburban regions. Two teams of surveyors worked at each site collecting fish downstream and upstream. Habitat assessment and water quality parameters were also examined at each site and included D.O, temp, pH, conductivity, TDS, nitrate, and phosphorus measurements. In three years of surveying, over 2,000 fishes comprising 20 species were captured, identified, and released following on-site enumeration. IBI scores calculated were poor to fair with most sites dominated by tolerant minnow and sunfish species including stonerollers (Campostoma oligolepis), creek chubs (*Semotilus atromaculatus*), green sunfish (Lepomis cyanellus), and bluegill sunfish (*Lepomis macrochirus*). Comparisons of fish assemblages show a reduction in overall species number in current versus historic reports (ADCNR heritage database). Although some inconsistencies related to reclassification of species can account for species loss, an overwhelming number of missing species is evident. We suggest that habitat degradation is a major factor influencing assemblages considering water quality among all sites was similar.

P250 - Biodiversity from Freshwater Lentic Ecosystems Revealed with eDNA

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Lentic ecosystems, encompassing still or slow-moving water bodies like ponds, lakes, and wetlands hold a distinct ecological and biological character when compared to their flowing counterparts such as rivers and streams. The stagnant water characteristic of these ecosystems allows for the accumulation of sediment and organic matter, resulting in diverse and nutrient-rich habitats. These ecosystems play a vital role, contributing to biodiversity, providing homes for aquatic and terrestrial species, storing water, regulating water quality, and supporting various human activities like fishing, recreation, and agriculture. However, these ecosystems are not immune to challenges, including pollution, invasive species, habitat destruction, and the impacts of climate change. These issues pose significant threats to the health and functioning of lentic ecosystems, ultimately affecting human well-being. This study outlines a comprehensive research plan with a specific focus on understanding how human activities, as reflected in population density and land usage, impact the biodiversity of lentic ecosystems. Multiple water bodies in the Chattanooga area are being studied, and biodiversity is being assessed

using an environmental DNA approach. The anticipated findings from this study aim to provide essential information guiding the development of strategies to mitigate the adverse effects of human activities on lentic ecosystems. The ultimate goal is to promote sustainable practices that ensure the ongoing health and usability of these ecosystems for the benefit of future generations.

P251 - Tornado effects on abiotic conditions and tree diversity in a Kentucky mesic hardwood forest

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Severe storms, like tornados, cause major forest canopy disturbance, leading to environmental and successional changes. Tornado distribution in eastern United States is changing, which prompts us to increase our understanding of tornado effects on deciduous forests. Compared to control plots, we expect disturbed plots to have changes in abiotic conditions, a higher presence of shade intolerant species, and greater tree diversity. Our study site, Clay Hill Memorial Forest (Taylor County, KY, USA), was severely disturbed (~20 ha of forest) by an EF3 tornado on December 11, 2021. Twelve 25*25 m plots were mapped in 4 groups according to slope, aspect and soil type. Each group has 1 control and 2 paired disturbed plots. We identified and measured DBH of all uprooted trees and all standing trees taller than 1.80 meters. Since July 2023, at the center of each plot, we measured soil temperature, air temperature and light hourly. We used the Shannon Wiener diversity index to observe changes in diversity; we used the Importance Value of each tree genus to quantify compositional changes. Abiotic conditions were compared within clusters. Average maximum and minimum air temperatures were significantly higher and lower, respectively, in the disturbed plots. The forest floor in the disturbed plots received more light than the control, but soil temperature did not differ between disturbed and control. In support of our hypothesis, overall diversity was positively correlated with disturbance. Shade intolerant species such as *Liriodendron tulipifera*, *Cercis canadensis*, and *Ailanthus altissima*, had a higher Importance Value. Some Quercus seedlings were present in the disturbed but absent in the control. The results suggest a potential change in future forest composition. Our goal is to continue assessing forest succession while adding salvage logging to half of the tornado disturbed plots to shed light on the cumulative effect of both disturbances.

P252 - Investigating the Influence of Grass-Root Interactions on Shrub Encroachment in a Coastal Grassland

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Shrub encroachment is occurring in ecosystems worldwide but provides unique ecological scenarios in barrier island systems where shrubs disrupt the natural response to sea-level rise by reducing sediment flux to the interior. Warming winter temperatures are a driver of coastal woody encroachment by reducing freezing induced embolism. However, biotic interactions may also influence the encroachment process through grass-shrub belowground interactions (i.e., competition, mycorrhizal fungi facilitation) in nutrient poor environments. A hoop house experiment was set up to determine the extent to which belowground biotic interactions with grasses influence the growth of *Morella cerifera* seedlings (a native, evergreen shrub) by allowing or excluding root interactions. Shrub growth metrics included height, biomass, and canopy area. After twelve weeks, significant increases were observed in growth metrics for shrub seedlings interacting with grasses. Average height growth rate was 55% higher when roots interacted (interaction: 6.45 ± 0.51 cm, no interaction: 4.16 ± 0.44 cm, $p<0.01$). The average canopy area growth rate was 77% higher when interacting (interaction: 177.82 ± 17.81 cm, no interaction: 99.48 ± 15.84 cm, $p<0.01$). Access to grass roots has a significant impact on both height and canopy area. Belowground interactions have a positive effect on shrub growth potentially impacting their encroachment into grasslands.

P253 - Variations in the Microbiome of Drinking Water at Concord University

Josie Crawford, Sydney Phipps, Kimberly Chambers

Concord University, Athens, WV

The importance of providing a safe and reliable drinking source is a continuous task across the globe. Analysis of the communities of microbiota found in drinking water will elucidate the types of microorganisms interacting with the human gut and its microbiome which may be of significant importance to public health. In this study, 16S rRNA gene sequencing will be used to examine the microbiological content of drinking water on Concord University's campus. For analysis, one sample was collected at 8 AM on Monday, and one sample was collected at 12 PM on Friday for three consecutive weeks. Our goal is to analyze the changes within the microbiome of drinking water at Concord University over the span of multiple days to identify a possible cycle associated with water filtration and cleanliness.

P254 - Does human activity impact provisioning and nesting success of Osprey at Reelfoot Lake?

Skylar M. Lowery, H. Dawn Wilkins

University of Tennessee at Martin, Martin, TN

Reelfoot Lake is a natural, shallow lake with a healthy population of fish desired by humans and Osprey (*Pandion haliaetus*). Many people visit the lake to fish, duck hunt, and observe wildlife. Our goal was to determine if human activity impacts provisioning and nesting success of Osprey. We compared twelve Osprey nests located in Middle Basin, and twelve nests in Upper Blue Basin. More boats per hour were observed in the Middle Basin, however, their speed and distance from nest were similar between basins. Thirty percent of nests in Middle Basin successfully fledged young, while 50% of nests in Upper Blue Basin were successful. There was no difference in the mean number of young fledged per nest or mean number of fish brought per hour between basins. Since human presence may impact nesting success, we recommend staying a respectful distance from the nests during the breeding season.

P255 - Top-down and Bottom-up Forces in a Puma, Mule Deer, and Elk System

Travis Perry, Stella Frisbie

Furman University, Greenville, SC

Ecological communities are structured in part by a combination of top-down forces, such as predation, and bottom-up forces, such as forage availability. We examined the relationships among mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), puma (*puma concolor*) and annual precipitation to better understand the relative role of these forces in this predator-prey system. We predicted that: 1. mule deer and elk photo rates would increase with precipitation; 2. puma photo rates would increase with mule deer and elk photo rates; 3. mule deer and elk photo rates would decrease with puma photo rates. The study area is located in Sierra County, New Mexico. Photo data were collected, uninterrupted, from 2009 to 2019, from twenty-five remote cameras distributed over 100 km² at a density of 1 camera per 4 km². We assumed that species' photo rates were strongly correlated with abundance of that species. Precipitation data was collected from the NOAA (National Oceanic and Atmospheric Administration) weather station in nearby town of Hillsboro, New Mexico. We found: 1. Mule deer and elk photo rates increase significantly with precipitation with a one year time lag ($p=0.032$; $p=0.33$ respectively) but these correlations decrease over time; 2. Puma photo rates increase strongly with mule deer photo rates ($p=0.09$) and significantly with elk photo rates ($p=0.0002$) with a one year time lag, and again the strength of these correlations decreases over time. 3. Mule deer and elk photo rates trend downward with puma photo rates with two and three year time lags, but these relationships are not statistically significant. Our findings suggest that bottom-up forces, i.e., food availability resulting ultimately from precipitation, are the primary drivers of puma, mule deer, and elk abundance on our study area, as has been demonstrated for these species in similar southwestern environments.

P257 - Ashes to ashes: documenting the annual decline of a green ash dominated swamp in the NC piedmont since 2019

Salem Fleming, Emma Halstead, Arilyn Lynch, Madison Kluge, Matthew Rodriguez, Jay Bolin

Catawba College, Salisbury, NC

The Emerald Ash Borer (EAB) is an invasive species in the United States. We measured the decline and patterns of change in a Green Ash (Fraxinus pennsylvanica) dominated swamp forest in the Catawba College Fred Stanback Jr. Ecological Preserve (FSJEP). In the fall of 2019 we established six, 200 m2 plots using a nested plot design to measure changes in the canopy, sapling, and herbaceous vegetation. We resampled the plots in fall 2020, 2021, 2022, and 2023. Our data indicated low diversity in the tree canopy, tree importance values in descending order, green ash, sweet gum (Liquidambar styraciflua), red maple (Acer rubrum), black willow (Salix nigra), American elm (Ulmus americana), and the American Sycamore (Platanus occidentalis). In Fall of 2019 green ash trees were visibly showing signs of EAB infection. In Fall 2019 no ash trees were standing dead, but by 2022, 78% of the green ash trees were dead. The importance value of the green ash canopy declined from 2019 (IV = 1.61) to 2023 (IV = 0.19), and now is a minor component of the canopy. Sapling strata layer indicate that sapling diversity increased when the canopy declined and P. occidentalis and A. rubrum may form important components of the future canopy. Based on photometric methods canopy coverage declined strikingly from 73.1% to 4.84% from fall 2020 to fall 2023.

P258 - Does adding a plastic film to windows reduce the likelihood of fatal impacts by birds?

Austin Wise, Krista Yantis, Joe Poston

Catawba College, Salisbury, NC

Populations of several species of birds are declining due to a variety of factors such as habitat loss and pesticide use. One significant cause of bird mortality is impacts with windows. Apparently, birds do not perceive a window as a solid barrier, presumably because they see reflected vegetation and other features and believe they are flying toward those features. A variety of techniques have been developed to reduce the likelihood that a bird will impact a window. One type is a film applied to the glass that includes non-reflective features, often patterned as spots or lines. On the campus of Catawba College, one building situated near forested habitat has experienced significant fatal window strikes for birds. In response, the college applied a film to many of the windows. The film includes opaque horizontal lines that birds can see. The lines are spaced close enough that birds should not attempt to fly between them. We compared the number of window strikes before and after applying the window film, and found that the film was remarkably effective in reducing the chances that birds would fly into windows.

P259 - Interspecific interactions between *Ammophila breviligulata* and *Spartina patens* along a stress gradient

Caitlin Say, Julie Zinnert

Virginia Commonwealth University, Richmond, VA

Dunes are a critical part of coastal ecosystems. As nature-based features, they serve as a means of protecting the coast from flooding associated with sea level rise and storms. Many areas along the coast rely on the dune-building characteristics of vegetation, often grasses, that are stimulated to grow with sediment burial. *Ammophila breviligulata* and *Spartina patens* are two prominent dune grass species along the mid-Atlantic coastline. They effectively build dunes by trapping sand. *A. breviligulata* and *S. patens* are often found coexisting in the environment. A previous greenhouse study suggests these species have a positive interaction when grown together but it has not been tested in the field to determine whether they have a facilitative, competitive, or neutral relationship. Using the stress gradient hypothesis, we hypothesize that both species will exhibit a facilitative relationship under high stress and neutral interactions under low stress. By conducting a field experiment removing one species from another, we can determine the biotic interactions and the

relationship between these two species. A better understanding of these interspecific interactions can aid in dune management and guide restoration methods. With the threat of climate change and rising sea levels, dune restoration is more necessary than ever. By considering interspecific interactions and biodiversity in restoration efforts, we may enhance plant survival and more efficient dune building.

P260 - Climate change and threat assessments for rare, threatened, and endangered plant species of Chesapeake & Ohio Canal National Historical Park

Mrs. Clara Thiel, M.S.

Frostburg State University, Frostburg, MD; Appalachian Laboratory, University of Maryland Center for Environmental Science, Frostburg, MD

Threat assessments are often used to prioritize and inform conservation efforts for a given species or ecosystem by compiling regional information related to natural, anthropogenic, and climate-related factors. Within the mid-Atlantic, stressors related to invasive species, changes in land use, and climate change are prevalent and threaten natural resources throughout the Potomac River corridor and nearby habitats. Chesapeake & Ohio Canal National Historical Park, which encompasses 184 contiguous miles of riparian and forested habitat adjacent to the Potomac River, currently supports a total of 106 plant species and several ecosystems that are ranked as state or globally rare, threatened, or endangered. To better inform conservation efforts for these species and ecosystems, evaluations will be made using the NatureServe Threat Assessment and Climate Change Vulnerability calculators to provide park-specific assessments for species of special concern within Chesapeake & Ohio Canal National Historical Park. Due to the Park's urban and riparian settings, it is expected that sensitivities to changes in land use and flood events are likely to be driving factors related to vulnerability of rare plant populations. The resulting species assessments will provide a basis for future conservation efforts within the park and identify ecosystems of particular concern and importance for conservation and management in light of a changing climate.

P261 - The Bird Community Using Large Trees Differs in Urban Versus Rural Forests

Rachel Derwart

Lee University, Cleveland, TN

Large trees are considered keystone structures in a forest ecosystem due to the habitat and food sources they provide for wildlife. We wanted to determine if the location of these large trees, urban versus rural, affected their impact by observing bird diversity. We chose to observe birds because they are model organisms that are easy to identify and commonly used to measure overall diversity of an area. The urban forest was Lee University while the rural forest was Johnston Woods. Large trees were defined as any single-stemmed tree that was at least 80cm D130. Each tree that fit this criteria was observed on four separate occasions in 20-minute intervals during the span of two months. Any bird that was within a 10-meter radius of the stem of the tree was counted, and its species was recorded. Bird calls that were heard and could be identified were also recorded. The top five most abundant species ended up being the same at both locations but appeared in different proportions, with the most abundant being the American robin. The data was analyzed using Simpson's reciprocal index and the Shannon-Wiener index to measure bird diversity. There were more trees at Lee that fit the previously listed criteria than there were at Johnston Woods. Therefore, there were more individual birds observed at Lee. To prevent this from skewing the data, the results were looked at in two ways: using the original total values from each site and using only a portion of the Lee data so that the number of individuals observed is the same for each site. Both ways of looking at the data suggests that Johnston Woods has a more diverse bird population compared to Lee.

P262 - Native Tree Species Success in Riparian Restoration Zones in Rockingham County, Virginia

Celeste Breeden Blankenship, Nina Ravel, Erek Valesky, Heather Griscom

James Madison University, Harrisonburg, VA

Landowners today are increasingly recognizing the importance of restoring riparian land previously degraded by agricultural use. Programs like CREP (Conservation Reserve Enhancement Program) provide an incentive for farmers by offering them a tax credit and reimbursement for conservation costs. Incorporating native tree and shrub species that have high value for wildlife is important for long-term ecosystem health and restoration. However, the relative success of many species used in these restoration management plans is unknown. We quantified planted woody species growth and survival on two farms, Harpine and Green Hill Farms, enrolled in CREP for five and two years respectively in Rockingham County, Virginia. Height, basal diameter, and survival were recorded in the spring of planting. At the end of each growing season (late fall) we also recorded evidence of deer browsing in addition to the aforementioned variables to determine the overall success of 24 different species. Overall, survival of the 539 plantings at Harpine Farm was 68.2% after five years, and 73.7% of the 444 plantings at Green Hill Farm after two years. At Harpine Farm, *Platanus occidentalis*, *Robinia psuedoacacia*, and *Liriodendron tulipifera* were among the best survivors and fastest growers. Green Hill Farm's best-performing species included *Amalanchier canadensis* and *Platanus occidentalis* in terms of growth and survival. Some species contained higher survival rates, but not necessarily high growth rates. Growth rates were not indicative of survival (Green Hill R^2= 0.104 and Harpine R^2 = 0.053). Each farm is surrounded by differing densities of forest composition; Harpine Farm is surrounded by a thick forested area, which could promote the presence of deer, whereas Green Hill Farm is surrounded by minimal forested areas. We conducted analyses on the relationship between survival and recorded deer browse to determine that *Cornus amomum* is a great candidate for planting at deer browsed farms.

P263 - Life History and Spatial Distribution of an Invasive Earthworm *(Amynthas)* Within West Liberty University's Campus Woods

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Department of Organismal Biology, Ecology, and Zoo Science, West Liberty University, West Liberty, WV

Amynthas is an invasive genus of earthworm native to the Korean peninsula and many of the Japanese islands. It is considered potentially damaging to the native ecosystem via its detrimental effects towards soil quality, the competition with other species of earthworms, and its disturbance to animals which naturally feed on earthworms such as salamanders. To limit the threat that this genus poses it would be best to reveal the life history of the genus in question. This has been done via a survey plot conducted on a weekly basis for three seasons over the course of three years. The purpose for this study was not only to uncover the unknown ecological damage that this species could be causing, but to hopefully lead to a solution in the future. A comparison was done between *Amynthas sp.* and juveniles of other earthworm species found in the survey. Growth rates were determined, and it was found that *Amynthas* juveniles grew faster than their non-*Amynthas* counterparts. Similar results were found in 2022 surveys. Additionally, density was found to be impacted by drought conditions present in both years. *Amynthas sp.* are prolific breeders and can achieve high densities within forest soils. A population of them requires large quantities of leaf litter, are known to disturb natural soil content including nutrients, which can damage plant communities. This is especially damaging to juvenile plants as *Amynthas sp.* are capable of consuming large amounts of undergrowth and preventing new trees from growing.

P264 - Introducing a Course Based Undergraduate Research (CURE) Special Topics environmental DNA (eDNA) Course: with a Report on the Detection of Rare Mussels from the Little Tennessee River of North Carolina

Mark Dugo, Lacasha Slade-Lawson, Tkeyah Dennard, Rashawna Huntley

Johnson C. Smith University, Charlotte, NC

Johnson C. Smith University (JCSU) is Charlotte's only Historically Black College or University (HBCU) and the number one ranked private HBCU in North Carolina. Over the past several years, our environmental and sustainability programming has incorporated active science education research aimed to increase the participation of African Americans (AAs) in sustainability and environmental sciences, and to improve stakeholder engagement in the environmental sector. Over the past three years, we hosted summer immersion programs for undergraduate students that included travel across multiple physiographic provinces. During the fall academic semester a collection of water samples were later used for analysis in a special topics eDNA course (BIO 491). In this course students are introduced to a mix of textbook material and engage in projects using real-world eDNA samples. Students learn laboratory skills through the use of qPCR analysis and also have the opportunity to analyze metabarcoding data contextualized to address relevant biodiversity concerns. Herein, we report on a metabarcoding dataset representing eDNA samples collected from five locations of the Little Tennessee River, each sampled in duplicate (n=10). Sampling sites were guided by the North Carolina Museum of Natural Sciences collections database accessed online. Using a cytochrome c oxidase (COI) metabarcode, 30 unique sequences were recovered representing a total of four species each from different genera. The samples averaged a 99.2% match with BLAST sequences from GenBank and none were less than a 97.4% match. The Tennessee Clubshell, Pleurobema oviforme, was detected from two samples from two different locations. The Rainbow, Villosa iris, was detected from seven samples from five different locations. This experiential learning activity and our findings will be discussed in context to broader applications for addressing modern environmental threats.

P265 - A bird's eye view on human disturbance

Katie Egan, Danielle Langley, Emily Prince, Lisa McDonald

Lander University, Greenwood, SC

Habitat loss, urbanization, and the introduction of non-native species often decrease species diversity. However, the relative impacts of different types of disturbances are not equal. Longer lasting disturbances include deforestation and constructing infrastructure, while activities such as hiking and dog-walking are more temporary. Previous research in our lab demonstrated that habitat type, human infrastructure, and human presence alter mammal activity patterns and other behaviors but do not significantly alter mammal species diversity. We are interested in determining how these same categories of human disturbance affect species diversity in birds. We predicted that species diversity would be higher at sites with higher habitat heterogeneity and lower at sites with high human presence and infrastructure. To test our hypotheses, we collected data using camera traps placed at six sites with 3-4 stations each. Each camera station was marked as an open, edge, or forest habitat type. An infrastructure score was determined by calculating the density of roads and buildings around each camera using GIS. Human presence was quantified using the frequency of images containing human activity at each station. For each bird observation, we recorded the species present and used the Chao estimator to determine S_{max} for each site and each station. We found a positive correlation between habitat heterogeneity (as measured by the number of habitat types per site) and bird diversity (S_{max}). Human infrastructure did not affect avian species diversity, but stations with higher human presence had lower avian diversity. Overall, we found that birds respond differently to different types of disturbance. Human presence decreases avian species diversity, likely because some species of birds spatially avoid sites where humans are common. However, humans also cut down forests and maintain open fields, which can increase bird diversity by creating niches for a wide range of species.

P266 - Micro and Macro Plastics in Carolina Chickadee Nests

Teaghan McAllister, Olya Milenkaya, Yuemei Zhang

Warren Wilson College, Swannanoa, NC

Birds have evolved specialized nests, varying across habitats and available resources. But those habitats and resources are now changing, as multiple anthropogenic factors, including plastic pollution, threaten birds. The intensity and prevalence of plastic pollution in bird nests remains unknown. I intend to better understand the impact of human activity on birds by studying the presence and quantity of synthetic material within nests. I hypothesize that birds near human-impacted areas use more synthetic material within their nests. Therefore, I predict that there will be negative correlations between plastic content and their distance to human-impacted areas. I used Carolina Chickadee (Poecile carolinensis) nests, collected over three years (2021 – 2023), from standardized bird boxes in varying habitats at Warren Wilson College in western North Carolina, USA. After recording initial nest measurements, I isolated microplastics through water-bathing and filtering. I then assessed microplastic presence through fluorescence detection under a microscope. Next, I dissolved the natural nesting material of the nest linings with 7% sodium hypochlorite solution for 9 weeks, thereby leaving me with just the macroplastics. I confirmed that these were plastic by using fluorescence detection. I then compared the mass of this isolated synthetic material to the initial nest mass to determine the proportion of each nest that was made-up of macroplastics. I will use a linear regression to compare the amount of macroplastic to the distance between nests and their closest human-impacted area. For this study, I am considering roads, rivers, and buildings as high human-impacted areas because they are major sources of plastic pollution. For microplastic analysis, I will test how the probability of microplastic presence relates to proximity to human-impacted areas. I predict that both the quantity of macroplastics and the presence of microplastics will be higher in nests that are closer to sources of plastic pollution.

P268 - Ghosts in Glass: Ghost Crabs as Judges of Glass Sand for Coastal Restoration

Emily Parrish, Jeremiah Henning

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Coastal erosion impacts ecosystems worldwide. For instance, the State of Louisiana loses nearly a football field worth of land every 100 minutes, resulting in thousands of square miles of lost coastline over the last 100 years. This drastic loss of coastal land highlights the dire need for coastal restoration across the Northern Gulf Coast. An unexpected solution to this sediment loss may solve two major environmental issues at once. Millions of tons of glass waste enter America's landfills each year. Rather than routing glass to a landfill, it can be crushed to create sand and gravel for coastal restoration sediment. Our goal is to determine whether glass sand is a viable option for coastal restoration by testing its impact on a critical indicator organism in coastal dune ecosystems, the Atlantic Ghost Crab, Ocypode quadrata. Ghost crabs were live-trapped from Dauphin Island, Alabama and reared in sand environments containing full beach sand, half beach sand and half glass sand, and full glass sand for 8 weeks. In order to compare the stress responses of each treatment, the crab's initial and final stress hormone levels (Crustacean Hyperglycemic Hormone), carapace widths, weights, and claw dimensions will be collected as well as final reproductive investment (GSI), energy storage (HSI), and stomach dimensions. If the crabs don't appear to be more stressed in the glass sand, then there is potential to use it for large-scale restoration efforts both locally and globally.

P269 - Hourly and Seasonal Patterns of Visitation and Sociality of Eastern Bluebirds at an Artificial Water Source

Mackenzie Wallace, James Ferrari

Wesleyan College, Macon, GA

Hourly and seasonal patterns of visitation to water by Eastern Bluebirds were studied with a special focus on interspecific and intraspecific social interactions. Using a game camera, we captured photos of a bird bath once every minute from sunrise to sunset from September 2021 through August 2022, for a total of 266,311 photos. Each photo was reviewed, and each bluebird visit to the bird bath was categorized into one of three behavioral categories (perch, bathe, or drink) as well as four social categories: solo, with conspecific, with conspecific and heterospecific, or with heterospecific. Using the social categories, we calculated the bluebirds' Phi coefficient, a measure of sociality, as well as their Jaccard coefficient, a measure of the strength of associations, with the co-occurring bird species at the bird bath. Over the course of the twelve months, bluebird visits peaked in November and March with total visits of 259 and 269 respectively; both of these months had below average rainfall. A graph of daily bluebird visits shows a distinct peak in visitation from the hours of 3pm to 6pm. Of these bluebird visits, 72.4% were solo visits, 11.1% were with conspecific, 3.3% were with conspecific and heterospecific, and 13.2% were with heterospecific. The bluebirds' degree of sociality varied throughout the year, with their Phi coefficient being highest during the fall months at 0.089 and lowest during the spring months at 0.038. Bathing and drinking are in some respects riskier than foraging for food. When bathing, birds' feathers become drenched, making flight more difficult. Additionally, when drinking, the birds' heads are down, and they are briefly unable to see an approaching predator. Social behavior at water sources enhances vigilance and thus reduces predation risk, but extrinsic abiotic factors (e.g. precipitation, temperature) and the nesting cycle also influence patterns of bluebird visitation.

P270 - Does Shelter Type Affect Riparian Tree Growth and Survival?

Emmaline Clark, Elizabeth Stanley, Alexander Busch, Christina Henriksen, Owen McDonald, Kiley Plum, Skyler Reese, Bruce Wiggins

James Madison University, Harrisonburg, VA

Riparian forests serve as buffers between a water source and productive land and are valuable to the health and prosperity of ecosystems. These forests can be restored by planting trees in protective shelters, which may be ventilated or non-ventilated. Non-ventilated shelters can experience extreme heat inside, whereas ventilated shelters do not experience as much heat. This study explores the potential impact of shelter type on the percentage growth and survival of riparian trees overall and between species, focusing on three restoration sites at Whiskey Creek Regenerative Farming in Augusta County, Virginia. The experiment includes ventilated and non-ventilated shelters, with 300 trees tagged in Fall 2022 in 30 groups. Measurements of height, stem diameter, and shelter type were recorded in both Fall

2022 and Fall 2023, with species identification in the latter. There were no significant differences in proportional growth of height and stem diameter between shelter types, and approximately 80% of trees survived after two years with no differences in survival between shelter types. The distribution of percent change in height and percent change in diameter is consistent across all species. Excluding outliers, Liriodendron tulipifera exhibited the highest percentage growth in height (64.04%), while Cornus sericea showed the greatest growth in diameter (97.80%). Ongoing monitoring is planned to assess the long-term impacts of shelters on tree growth and survivorship.

P271 - Analyzing Wildlife Abundance and Composition within Rural and Suburban Landscapes in Roanoke, Virginia

Kristina Aucoin, Rachel Collins

Roanoke College, Salem, VA

Habitat quality is important for wildlife to be able to maintain populations in a particular landscape. Suburban and rural landscapes provide different resources to wildlife that either promote or inhibit wildlife populations. Suburban Landscapes have more fragmentation and less high-quality habitat than forested rural areas. Suburban landscapes can have woodlots that provide important resources for wildlife. Understanding how wildlife populations use rural and suburban landscapes differently can give insight into managing human-wildlife conflict and wildlife conservation. In this study, we used wildlife cameras to assess how wildlife uses these two types of landscapes, in Roanoke County, Virginia. Specifically, we compared 1) species diversity and composition, camera trap success, and latency to capture. We found species diversity to be similar but not species composition between the two landscape types. Camera trap success was higher and latency to capture lower in suburban compared to rural landscapes. Taken together our results suggest that suburban woodlots draw wildlife causing them to be used because they offer habitat requirements not found in the wider human dominated landscape.

P272 - Paving the Way for Effective Plant Conservation

Sarah Norris[1], Carrie Radcliffe[1], Emily Coffey[2]

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The Southeastern Plant Conservation Alliance (SE PCA) is a diverse partnership that bridges gaps between local and national efforts while collaborating to restore and prevent the loss of plant diversity. This is achieved by building capacity, facilitating novel partnerships, and leveraging shared resources to stimulate collective success in our region. The SE PCA has provided a platform to achieve the following:

(1) Advocating for plants with other nationally recognized groups, we urged the Biden administration to prioritize the conservation of native plants and ecosystems. We also developed free-access information sheets on regional needs, goals and activities.

(2) Ex Situ Gap Analysis - The SE PCA partnered with Botanic Gardens Conservation International - U.S to conduct an ex situ gap analysis to evaluate regional ex-situ collections of priority species and identify gaps needing to be filled to meet conservation needs for priority species.

(3) Improving Recovery Outcomes for the Endangered Species Act - With collaboration from USFWS, we have defined 13 high-priority federally listed species and are implementing pilot projects to support on-the-ground conservation action (including research and management), education & outreach to partners and landowners, the promotion of public and private land partnerships, and facilitation of working groups and workshops.

(4) List of Regional Species of Greatest Conservation Need (RSGCN - The SE PCA has developed the nation's first Regional Species of Greatest Conservation Need (RSGCN) for plants, which directly enhance data, consistency, capacity, and awareness for plant conservation – this will support research, restoration, regulatory, engagement, and leadership efforts.

P273 - The Impact of Mercury Contamination on Avian Malaria Prevalence

Savannah Gibbs, Paul Callo

Mary Baldwin University, Staunton, VA

Limited data is currently available on the prevalence of avian malaria in terrestrial songbirds, specifically Carolina Wrens (Thryothorus ludovicianus), after contamination. From October to December 2023, we conducted a research study to address this knowledge gap. We collected blood and feather samples from Carolina Wrens residing along the South River in Waynesboro, Virginia, to investigate the potential impacts of contamination on avian malaria. After collection, the blood samples were placed on slides and stained using the Giemsa staining method. We will then examine the stained blood cell slides to determine the prevalence and intensity of avian malaria infections in the collected samples. We hypothesize that the prevalence of avian malaria will be higher in the samples collected from birds residing downstream of the contamination source. By conducting this study, we aim to contribute to the growing body of scientific knowledge by contributing to the existing body of literature and serve as a valuable resource for future research efforts on the relationship between mercury contamination and the prevalence of avian malaria in terrestrial songbirds.

P274 - A test of the efficacy of protective devices for use in direct seeding of longleaf pine

Morgan Wingo, Anna Rose, Dalton Brantley, Timothy Chesnut, Martin Cipollini

Berry College, Mount Berry, GA

We evaluated the effectiveness of seed shelters (Seed Crowns) for use in establishing longleaf pine (Pinus palustris Mill.) seedlings for restoration. While longleaf pines are primarily planted using 1- to 2-year old plug seedlings, planting plugs in certain field sites (e.g., rocky sites) may be difficult. Furthermore, plugs may not be available with the appropriate genotype for a given site. Direct seeding might be used when planting plugs is unfeasible; however, seed predation by birds and other animals then becomes an impediment. Longleaf pine seed and seedling survival might reach acceptable rates when seeds are planted within protective shelters. To test this concept, we carried out studies at four sites on the Berry College campus near Rome, Georgia, and at two sites in middle Georgia (Indian Grave Mountain and Sprewell Bluff). At Berry College, 65-80 shelters were installed (two seeds per shelter) at each site along with 15-20 control spots (seeds planted without shelters). At three subsequent dates, we recorded germination and survivorship at each spot. At the middle Georgia sites, all seeds were planted within shelters (no controls) and 10 to 50 spots were planted at five subplots at each site as a general test of field implementation. Across all Berry College sites after 5 months, sheltered seeds had an 86%, 14%, and 24% improvement over controls in seeds present, seedlings alive, and spots with at least one seedling alive, respectively. At Indian Grave Mountain, 35% of seedlings were alive after 5 months and 52% of spots had at least one survivor. At Sprewell Bluff, 77% of seedlings were alive after 4.5 months and 90% of spots had at least one survivor. Taken together, these results suggest that direct seedling using Seed Crown shelters may be a viable option for planting when conditions prevent the use of plug seedlings.

P275 - Nesting Rock Preferences for Eastern Hellbender Conservation

Sarah Wood, Michael Freake

Lee University, Cleveland, TN

The eastern hellbender (Cryptobranchus alleganiensis alleganiensis) is listed as state endangered in Tennessee due to population decline over the last several decades. One factor is the human impact of channeling and damming of small streams and rivers. With conservation efforts in mind, we wanted to determine what nesting rock preferences hellbenders have for mating and laying eggs. We used two sites to conduct the research in Tumbling Creek in Polk County, TN near the Ocoee River, and Oosterneck Creek in Tellico Plains. Hellbenders were located using snorkeling gear and a flashlight to look into crevices. Rocks with confirmed hellbenders inside were flagged with flagging tape and its coordinates were recorded using Bad Elf GPSS Surveyor GPS receivers. We measured the rocks with hellbenders present according to the rock attributes: the size and shape of the rock, number of entrances, entrance orientation, cavity depth, percent embeddedness, crevice opening diameter, percent coverage of moss/algae, and river depth. We then compared the measurements of the rocks that have hellbenders and those that do not have hellbenders present and compared the rocks without eggs versus those with eggs inside that are labeled as nesting rocks.

For the control group, a random generator was used to pick between 0-360° and less than 25 meters from the occupied rock to randomly select rocks that hellbenders do not occupy and then to measure the rock attributes. A rock is considered unoccupied if a hellbender is not present and the rock is greater than 38 cm. The data was analyzed using R-studio and p-values found using a Logistic Regression Model. After assessing the data we found that it is suggested that eastern hellbenders do have preferences in the area of the rock. Although there is inadequate data for the remaining rock attributes.

P276 - Higher percentages of tree canopy cover correlate with more bird diversity in urban parks in Nashville, Tennessee

Lydia Mitchell, Colin Swanson, Darlene Panvini

Belmont University, Nashville, TN

Bird diversity is an indicator of the overall biodiversity in urban green spaces. Identification of factors associated with urban green spaces that strongly influence bird biodiversity can inform the development and management of urban green spaces. Previous studies found that parks with larger areas of impervious surfaces had lower bird diversity than those with more tree canopy coverage. This study used iTree Canopy to determine the percentage of tree canopy versus impermeable surfaces for four different urban parks in Nashville, Tennessee. Two parks were closer to the urban core and two were farther away. Tree canopy and impermeable surface cover were compared to biodiversity of bird species. Birds were identified using acoustic song meter recordings within each of the parks, with the recordings being sorted via Kaleidoscope cluster analysis software. Thirteen and eleven bird species were recorded in high and low tree canopy sites, respectively, and more bird sounds were recorded in high tree canopy sites. Analysis of the data suggests that parks with higher percentages of impermeable areas relative to tree canopy had lower overall bird biodiversity. Managing parks for more tree canopy coverage and less impervious substrates can enhance urban bird diversity.

P277 - Partners for Agricultural Innovation and Sustainability: Collaboration in West Alabama and East Mississippi in Support of Conservation and Agriculture.

Aubree Plymale[1], Caleb Mullins[2], John McCall[1]

[1]University of West Alabama, Livingston, AL, [2]Stephen F. Austin State University, Nacogdoches, TX

For six years, two USDA-funded projects projects centered at the University of West Alabama (UWA), have assisted agricultural stakeholders in West Alabama and East Mississippi with invasive species management, prescribed fire assistance, and pollinator

support. These partnerships between UWA, the Sumter County, AL Soil and Water Conservation District (SCSWCD) and two area community colleges have trained over 40 student interns to provide hands-on assistance in the field. PAIS 1.0 (Partners Against Invasive Species), funded in 2018, focused on the fight against invasive species, notably cogongrass (*Imperata cylindrica*) and feral swine (*Sus scrofa*), and also established outreach for stakeholders (farmers, ranchers, and foresters) in the West Alabama region. The success of PAIS 1.0 led to Partners for Agricultural Innovation and Sustainability (PAIS 2.0). This program broadened the partnership to include two area community colleges, East Mississippi Community College (EMCC) and Coastal Alabama Community College (CA). PAIS 2.0 continues to provide education and assistance in the battle against invasive species; as of December 2023 the two programs had assisted in the eradication of some seven million square feet of cogongrass and 2500 feral swine in the region. In addition, PAIS 2.0 expanded the scope of the project by training student interns to assist stakeholders in other areas such as the application of prescribed fire. The PAIS programs have also stimulated an increase in student enrollment in conservation-related programs at UWA. Area landowners indicate that the impact of the PAIS projects has been overwhelmingly positive. In surveys conducted in January of 2024, 100% of respondents indicated that the PAIS program had proven very valuable in their efforts and of great value to the region. In addition, 96% of respondents found the PAIS interns to be extremely skilled and knowledgeable.

P278 - Nashville Public High School Green Spaces: A Case of Equality and Equity

Anna Lennon, Darlene Panvini

Belmont University, Nashville, TN

The presence of green spaces on and near school properties has been correlated to student mental health and academic achievement as green spaces can reduce levels of stress and improve cognitive function. However, there is a gap in the literature investigating how quality and quantity of green space is related to socioeconomic status and school economic metrics in public high schools or the surrounding neighborhoods. In many urban areas there is great diversity in socioeconomic status, access to green spaces, and quality of green spaces among public schools. Nashville public high schools located in higher socioeconomic areas and having greater financial resources were predicted to provide larger, higher quality green spaces. This study combined a quantitative analysis of neighborhood socioeconomic metrics, school socioeconomic metrics, and quantity of green space (assessed using iTree Canopy) with a qualitative field assessment using the Neighborhood Green Space Tool (NGST). Cluster analysis reveals no correlation between green space quality and quantity with higher socioeconomic factors. However, both the cluster analyses and NGST scores indicate strong evidence of significant disparities by schools in quality and quantity of green space. These results raise questions regarding the equality and equity of green space within the Nashville public high school systems.

P279 - Rare grassland plant surveys and seed collection in the Georgia Blue Ridge and Ridge and Valley Regions

Isabelle Grovenstein[1], Cooper Breeden[2]

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In 2023, I volunteered with the Southeastern Grasslands Institute (SGI) to fulfill the objectives of the Marie Mellinger Field Botany Grant awarded by the Georgia Botanical Society. There were two goals for the grant: surveying and seed banking rare plants of Northwest Georgia. I led surveys for *Solidago porteri,* a species for which there are only 4 known occurrences, one of which was recently extirpated.The purpose of the seed collections is to preserve the genetic integrity of rare and declining grassland plant populations in the Southeast in SGI's Conservation Seed Bank. We targeted rare species that were, to our knowledge, either not represented in any seed banks or whose ecotypes are not represented in seed banks. We determined sampling locations by working with other botanists, including those at Georgia Department of Natural Resources (GA DNR), to locate the appropriate habitats for surveys and collecting locations. For seed collections, we followed protocols adhering to best practices set forth by the Center for Plant Conservation. We combed six locations with suitable habitat for Solidago porteri. We did not find any new occurrences of the species, but we hope to continue these surveys in the future. We collected seeds from eight of the twelve target species we had permits for collecting. Many of the Georgia populations of these species were previously unrepresented in seed banks. We also uncovered a new population of the federally endangered species *Xyris tennesseensis* on protected property, the first newly recorded occurrence in fifteen years. The funding from Georgia Botanical Society provided a great opportunity for me, an undergraduate student, to engage in hands-on plant conservation work.

P280 - Fire Mediated Forest Structure Influences the Dispersal Dynamics of a Wind Dispersed Bunchgrass

Andrew Zachman

University of North Carolina Chapel Hill, Chapel Hill, NC

Maintaining the longleaf pine ecosystem requires establishing frequent low-intensity fire regimes through ground cover restoration. This study examines the impact of burn history on forest structure and its influence on the dispersal distance of *Andropogon ternarius*, a wind-dispersed bunchgrass, across nine North Carolina sandhills sites. Integrating simulated seed dispersal dynamics with terrestrial LiDAR metrics reveals that frequently burned sites exhibit significantly lower vegetation volume at the release height of *Andropogon ternarius* compared to infrequently and rarely burned sites. Infrequently burned sites display the highest vegetation volumes, attributed to leaf retention during dormant seasons. Moreover, a negative relationship between vegetation volume and diaspore dispersal distance is observed. Alterations to wind profiles, rather than vegetation collisions, explain this effect. Understanding the dispersal dynamics of wind-dispersed bunchgrasses not only aids longleaf pine ecosystem restoration but also provides insight into mechanisms contributing to ground layer species diversity in this ecosystem.

P281 - The effect of Arbuscular mycorrhizal fungi on growth of *Argnoglssom floridanum* at varying soil nutrient concentrations

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Sandhill communities in the southeastern US have been fragmented and reduced in area. With a diverse understory that includes many endemic species, effective restoration of these communities must consider the physical and biological properties of soil. This study aimed to understand the unique relationship between arbuscular mycorrhizal fungi (AM) and *Argnoglssom floridanum* at varying soil nutrient concentrations. Our goal was to understand how AM could benefit *A. floridanum* growth and additionally how this benefit may vary along a nutrient gradient. We grew *A. floridanum* seedlings in a greenhouse in potting soil inoculated with either "live" or sterile native sandhill soil. In addition, each pot received one of five concentrations of nutrient solution. We found that seedlings had more leaves when grown in "live" (i.e., containing AM fungi) soil compared to those grown in sterile soil. However, this advantage did not depend upon nutrient level. These findings suggest there is a positive relationship between the presence of AM fungi and *A. floridanum* and is the first study to demonstrate the importance of soil biota on the growth of a sandhill understory species.

P282 - I-Spy SAV: Exploring the Role of Remote Sensing in SAV Conservation in Currituck Sound, NC

Peggy Mullin

University of North Carolina at Chapel Hill, NC

Coastal submerged aquatic vegetation (SAV) is disappearing globally due to increasing sea levels, storm events, nutrient loading from agriculture, and other anthropogenic impacts. Like marshes and mangroves, SAV provides a host of ecosystem services like carbon burial through sediment trapping, which can mitigate atmospheric CO2. SAV also provides food and shelter for coastal species, facilitating the persistence of coastal ecosystems and contributing to the economic benefits of sightseeing, hunting, and fishing for coastal communities. There is an urgent need to better understand impacts to and rates of change within coastal habitats, in particular SAV presence and persistence. Ground-based mapping efforts are field-intensive and often underestimate SAV extent. In recent years, the spatiotemporal resolution and public accessibility of coastal remote sensing products has increased significantly, representing an opportunity to test the utility of these resources for habitat management. It is more important than ever to accurately map SAV habitats to understand and manage the factors contributing to net losses of ecosystem services in coastal environments. This work aims to use remote sensing products at various spatial and temporal scales to identify areas of SAV persistence and loss in the Currituck Sound of coastal North Carolina, where SAV habitat is both under-mapped and already estimated at significant rates of loss. Ground-level survey field work will be coupled with remotely sensed imagery to test the ability of remote sensing methods to create accurate SAV maps. Additionally, the utility of these methods to constrain other factors affecting habitat persistence, including marsh/shoreline proximity and underwater light availability, will be tested. Working with ongoing project partners in Currituck Sound, this work will directly inform future directions for ecosystem management in coastal NC.

P283 - Correlation Between Habitat Preferences and Mass (g) of *Nerodia sipedon sipedon* and *Regina septemvittata*

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Little information is known on the environmental habitat preferences of the Northern Water Snake (*Nerodia sipedon sipedon*) and the Queen snake (*Regina septemvittata*) in small stream ecosystems. *N.s. sipedon*, a subspecies of *Nerodia sipedon,* is a nonvenomous water snake with a large geographic distribution, commonly found in the Midwest to Northeastern United States. The Queen snake, *R. septemvittata,* is also nonvenomous with a smaller range, found in the Northeastern United States and Southern Canada. Throughout the activity period of 2023, the habitat preferences of these species were observed in North Fork of Short Creek, located in Ohio County, West Virginia. Specimens were captured via hand-collection herping along with the use of baited minnow traps. Prior to release, morphological and environmental data was recorded for each snake to identify if correlation was present between mass of an individual and its location in a riffle, run, or pool within the stream. Statistical analysis of the data indicates that significant correlation is present between stream type and the mass of both species of water snake. Determining the specific habitat selection patterns of these species can assist in assessing the quality of the stream ecosystem. By monitoring the snake populations, potential shifts in distribution can be detected, indicating a change in the quality of the stream. Overall, understanding habitat preferences is crucial for creating conservation plans for these species of water snake and the many organisms they interact with.

P284 - Who's who: Which birds are more likely to be admitted to an avian rehabilitation center in north-central Alabama?

John Matthew Erickson, Kristin A. Bakkegard

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Global bird populations are declining. Thus, it is important to understand if some orders of birds are more at risk than others. Often development can cause undesired effects on avian populations due to a variety of causes. A resource to combat declines are wildlife rehabilitation centers. The Alabama Wildlife Center (AWC) is a wildlife rehabilitation center located in Shelby County, AL primarily serving the north and central counties of Alabama. They specialize in the rehabilitation of injured and orphaned birds. To assess whether some orders of birds are more likely to require care at the AWC than others, we compared AWC's intake data (which also included

cause of injury if known) to Alabama Audubon's spring and fall bird count data for the years 2013-2021. Our null hypothesis was that the proportions of birds (by order) entering AWC for care should reflect the proportions of those birds (by order) observed in the wild during the bird counts. We found that this was not the case; certain orders are at greater risk than others in north and central Alabama. Of the 21 orders of birds in our data set, Accipitriformes and Strigiformes were the most at-risk orders, with more of them taken to the AWC than their proportions in the bird counts. The leading cause of injury to birds in the Accipitriformes and Strigiformes were vehicle collisions. In contrast, Apodiformes and Passeriformes had fewer admittances than their proportion in the counts. Understanding which and why specific orders of birds are sent to wildlife rehabilitation centers is important not just for rehabilitators, but also for designers, planners, and engineers to develop systems and structures that can reduce the risk of harm to birds.

P285 - Prey niche overlap of Jorō spiders (*Trichonephila clavata*) and Spotted Orb Weavers (*Neoscona crucifer*).

Alexandria Jennings, Karrie Ann Fadroski

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Jorō spiders (Trichonephila clavata) are native to Asia but were accidently introduced to Georgia and have established populations throughout the southeastern United States. Their large populations and massive webs have been labelled a nuisance to humans, but it is unclear what their impact on the ecosystem is. To determine if T. clavata is competing with native spiders, we compared the prey caught in T. clavata webs to prey caught in the webs of the similarly sized, native Spotted Orb Weaver (Neoscona crucifer). We surveyed webs at Hurricane Creek Research Property in Dahlonega, GA weekly for two months during fall 2023. We tracked a total of 26 pairs, each consisting of a N. crucifer and the nearest neighboring T. clavata. We laid a tarp underneath each species' web and extracted prey captured in the webs. During the following week(s), prey was retrieved from both the tarps and webs of the paired spiders. We also collected prey from unpaired webs of T. clavata. Pianka's Index indicated that there was some niche overlap between the species (PI=0.615); hemipterans were a major component of both T. clavata and N. crucifer diets. Trichonephila clavata also captured lepidopterans, coleopterans, and, to a lesser extent, hymenopterans most weeks. None of these orders were observed in N. crucifer collections. The prey retrieved from unpaired T. clavata had a similar composition to those found near N. crucifer, though coleopterans and hymenopterans were more frequent prey. The more durable and larger webs of T. clavata may be more efficient at collecting strong flying wasps and beetles. However, as T. clavata also consumes the preferred prey of N. crucifer, the spider species may compete, especially when prey densities are low.

P286 - Increasing Accessibility to Biological Collections Through Digitization

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Biological collections hold inherent scientific value due to the great diversity of physical specimens stored along with the associated archived data. Collections serve as historical and modern databanks, preserving temporal data that allow researchers from an array of disciplines to catalogue and evaluate biotic changes over time. Many collections continue to grow as curators and collection managers recognize the value of current investments to better serve future researchers. Although the value of scientific collections is indisputable, it is argued that limited access to these data is inhibiting its research potential and therefore the overall utility of such collections. As technology continues to develop, novel methodologies are introduced nearly every day that allow for increased data accessibility around the world. Past managers had the foresight that future generations could use their collections to address future biodiversity questions. We too must adapt to create new collection infrastructure as we face impending global change and other conservation challenges. Collections are well-known as an exceptional source of information, and maximizing accessibility unlocks an unparalleled commodity for researchers worldwide.

The biological collections owned and maintained by the University of Tennessee at Chattanooga have grown to include at least 200,000 specimens. Aside from the herbarium and insect collection, these collections are only available on local computers and have not been digitized and/or uploaded to any national or global databases. By uploading even one collections' worth of data online, UTC can increase accessibility to said data, which ultimately enhances the value of the overall collection. The benefits of uploading collections are best exemplified in three integral ways: contributing to big data projects, encouraging interinstitutional collaboration, and enhancing the quality of data via standardization using DarwinCore. With this project we aim to digitize and upload UTC's mammal and bird collections using Symbiota as a primary portal.

P287 - The Impact of Different Types of Green Space on Emotional State

Davis Dear, Ryan Adams, Nathan Ofotokun, Dr. John Quinn, Dr. Courtney Quinn

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Throughout the past decade, researchers have explored the potential benefits of green space on mental health. Many positive implications, such as reduced cortisol levels and increased resilience when working through mental illness, have been supported. However, more research is needed because the evidence is limited, and the variety of approaches used to attain data has made it difficult to draw conclusions. There has also been growing evidence that there are more positive associations with engagement in natural green space as opposed to virtual green space, but more data is needed to support this research. This study aimed to explore the relationship between exposure to green space, both real and virtual, and its potential benefits on the emotional state by using a mixed methods approach. Interviews were conducted while engaging in one of three gradients of green space- natural, constructed, and none, in either real or virtual space. Questions surrounded a participant's relational values, barriers to accessing green space, and overall mental and physical well-being. Before and after each interview, a pre-and post-survey focusing on time spent in green space and questions

surrounding the 10-item Perceived Stress Scale were asked. Heart rate variability was also measured for each participant's time. Preliminary results suggest that undergraduate students who walked in natural green spaces had a more positive emotional state as compared to those in the other gradients, and those with more positive relational values had a higher quality of life. This evidence suggests that the amount of exposure to green space and attitudes toward nature affect the overall quality of life, promoting the need for the public to spend more time in nature while also having the accessibility to do so.

P288 - Conducting Bat and Small Mammal Surveys at the Cahaba Biodiversity Center in Central Alabama

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The Cahaba Biodiversity Center in Bibb County, Alabama is a 2,100-acre property, on 4 miles of the Cahaba River, that was donated to the University of West Alabama in 2019. The Cahaba River is recognized by the World Wildlife Fund and Nature Conservancy as one of the world's biodiversity hotspots, therefore the center serves as potential habitat for many native species. From January 2022 through January 2023, baited and non-baited game camera surveys were deployed, allowing us to detect 12 terrestrial mammal species, including long-tailed weasels (*Mustela frenata*), a species of concern for the State. However, we have not been able to reliably identify rodents to species from the game camera data, and no extensive surveys of bats have been conducted on the property to date, though at least one hibernaculum is suspected on the property and several species are endangered in Alabama. This project aims to complete our noninvasive mammal survey efforts, as well as hopefully increase detections of weasels, through modified game camera surveys of small mammals and acoustic surveys of bats. We will be using game cameras in specialized boxes known as "Mostela boxes" to survey for small mammals. The addition of a specific lens to the camera, enclosed in a box, allows for easier identification as rodents pass through than traditional game cameras alone, and have had success in detecting weasels in other studies. We will apply standard acoustic survey methods for detecting bats. We will deploy bat detectors for a minimum of 4 nights per survey session near various habitat features. In conducting these surveys, we will provide the Cahaba Biodiversity Center with the basic mammal diversity data needed for more complex management decisions and research questions, as well as providing the State with further information on threatened species.

P289 - Dominant Seed Dispersal Modes of Invasive Plants in a Restored Urban Stream

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Restoration projects are commonly devastated by invasive plants post-construction. However, research on the modes of seed dispersal that facilitate the efficient invasion of these areas is limited. This study hopes to apply what is known about dispersal modes to invasive species to better understand how to mitigate these impacts in restoration projects. This study was conducted along Rocky Branch, a 1.1-mile-long, restored, first-order urban stream in Raleigh, NC. Restoration efforts consisted of three phases from 1999-2010, where existing vegetation was removed, natural stream channel design was constructed, and the stream corridor was re-planted. Today, Rocky Branch is an established closed canopy stream that is inhabited by wildlife. Following restoration, there has been limited maintenance of invasive species so many invasive species have since populated. From this study I hoped to learn if there is a dominant mode of seed dispersal for invasive plants across Rocky Branch, and if so, is this mode consistent across all three phases, which are 21, 17, and 13 years post-restoration. Methods consisted of sampling 10m wide sections every 30m, where stems were counted, and cover class for each stratum and invasive species were estimated. We discovered that of the 58 invasive species found, 24 dispersed their seeds via endozoochory (seed dispersal through ingestion and dropping of feces of vertebrates.) and accounted for 89% of invasive cover. In conclusion, we determined that species with endozoochory mode of dispersal are easily dispersed and tend to be very aggressive. These findings underscore the importance of continuous invasive plant management following stream restoration.

P290 - Multi-Categorical Analysis of Immature Bird Rehabilitation in the Florida Keys to Assess Ideal Care.

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The time management of daily care is a crucial factor in the success of animals in rehabilitation settings. This is especially true for parental care dependent young animals. Hatchling and juvenile birds make up over 50% of the birds that enter the Florida Keys Wild Bird Center, thus it is important to increase survival rates and reduce operating costs associated with rearing birds. The cost of rehabilitation is a concern since many rehabilitation centers are limited by their amount of funds. This lack of adequate funding can lead to the refusal of patients as well as reduce the care available for each individual. Decreasing the amount of care can incur issues in the individual animal's wellbeing as well as impede the long-term success of the rehabilitation center. By determining the best care strategies, rehabilitation centers are able to admit more patients and provide better care to increase chances of release success. Through the analysis of animal disposition in relation to care time and eventual release date, this study aims to determine if there is an ideal strategy that increases the success rate of rehabilitation centers.

P291 - Slope Dynamics on Bryophyte Frequency

Julie Zinnert

Virginia Commonwealth University, Richmond, VA

Mosses have a tendency to be more resistant to harsh environmental conditions that vascular plants cannot typically withstand. This is especially true when looking at topographical features. In Thomas Lee's comparative analysis of bryophytes and understory plant beta diversity in relation to elevation gradient, it was found that as elevation increases, vascular plant diversity has a tendency to decrease while bryophyte diversity stays the same (Lee et al, 79).

An observational study was conducted summer of 2023 at VCU's Rice Rivers Center in Charles City, Virginia, to measure bryophyte diversity in relation to substrate, topography, and proximity to a body of water. Ten transects were laid out perpendicular to a creek. Samples were collected, and information was recorded regarding the substrate, canopy cover, elevation, and sporophyte presence.

Contingency analysis showed a clear correlation between sporophyte presence and substrate, with a much smaller sporophyte presence found on epiphytic bryophytes. There was no significant correlation between elevation and frequency, nor between canopy cover and frequency.

P292 - Does human foot traffic changes the soundscape in an urban nature preserve

Erin Vaughn, Dr. John Quinn

Furman University, Greenville, SC

Recreational greenspaces provide habitat to wildlife while offering humans access to natural landscapes. However, the presence of anthropogenic noise in these areas can impact wildlife behavior and communication, particularly for avian species. To minimize these impacts data are needed on soundscape characteristics in areas with varying human foot traffic so that we can identify which areas are most favorable by avian species and implement land management practices accordingly to ensure recreational areas are suitable for the wildlife residing there. We deployed autonomous recording units (ARUs) throughout Consestee Nature Preserve, a 400 acre preserve in Greenville County, South Carolina, at sites located varying distances from recreational trails. We collected acoustic data over two months and soundscape indices were calculated from the recordings to evaluate the acoustic characteristics of sites with high and low human foot traffic. The data suggests that there was more acoustic complexity at sites located further from recreational trails where there was less human foot traffic. Increased acoustic complexity at locations with less human foot traffic indicates the influence of anthropogenic noise on avian species in the preserve and a preference of species to inhabit areas with less human foot traffic and anthropogenic noise. By taking this into account, Conestee Nature Preserve staff can better understand how the presence of human visitors can impact wildlife in the preserve and implement land management practices accordingly

P293 - Germination and plant growth of green bean seeds in the presence of Bisphenol B.

Riley Bowyer, Darla Wise

Concord University, Athens, WV

Three different concentrations of Bisphenol B (8ng/L, 15ng/L, and 20ng/L) were used to determine if exposure to Bisphenol B (BPB) impacts seed germination and plant growth. These seeds were monitored to determine how quickly the seeds germinate, form the radicle, and form the first true roots compared with controls. Due to the delayed growth of the radicle, there is a higher chance for BPB to inhibit proper growth of the root, which was observed with the beans grown in the higher concentrations of BPB. Further, seeds grown in higher concentrations of BPB had more difficulty, especially the 15ng/L concentration, with the survival rates of the beans. The viable seeds were moved to soil with the same concentrations of BPB as when germinated. Once the stems began to form, the roots in the higher concentrations of BPB began to exhibit unusual features. This was observed in multiple bean plants in the 15ng/L and the 20 ng/L concentrations. Additionally, these plants were observed to "flip" in the soil to completely expose roots and push a portion of the roots above the soil. The BPB concentrations used in this study are similar to those that can be found within waterways across the world, and these observations suggested that further investigation into reducing BPB levels in the environment is warranted.

P294 - Monitoring the Endangered Atlantic Pigtoe Mussel (Fusconaia Masoni) using eDNA and PCR

Michael Wright, Gracie Vickery, Sienna Brown, Megan Rudock Bowman

High Point University, High Point, NC

Fusconaia Masoni, better known as the Atlantic Pigtoe, is a critically endangered species of the mussel genus. Found primarily in North Carolina, this freshwater species plays an important role in maintaining North Carolina's unique and diverse wildlife, warranting strong conservation efforts. The Atlantic Pigtoe mussel population is currently being surveyed by traditional catch and release methods. Due to this species' small size and vulnerable state, this process can be time consuming, highly inaccurate, and even harmful to the mussel population. Alternatively, environmental DNA analysis can be utilized as a viable option for surveying species presence and potentially prevalence. Environmental DNA (eDNA) includes any genetic material shed by an organism within its own environment. Water samples from the Deep, Haw and Rocky rivers were collected and filtered on site to collect eDNA. In the lab, eDNA was purified and analyzed by PCR and gel electrophoresis. NCBI BLAST was used to identify PCR primers specific to the Atlantic Pigtoe and excluding all other species in the region. Currently an assay is being authenticated using PCR primers for a small subunit rRNA gene and a subunit of NADH dehydrogenase. DNA isolated from a sample of the Atlantic Pigtoe is used as a positive control. Universal primers for GAPDH confirm the presence of eDNA, while the presence of both a 167 bp product and a 329 bp product, from the NADH gene and rRNA gene respectively, indicate the presence of DNA from the Atlantic Pigtoe. Product sequencing will validate the use of this primer pair as a simple tool for species presence. Ultimately, the use of eDNA PCR assays in monitoring of the endangered Atlantic Pigtoe aims to increase sampling efficiency, allow for larger scale monitoring efforts and reduce our impact on these vulnerable species.

P295 - Traditional Ecological Knowledge of Virginia Barrier Islands

Isabella Ortiz-Miller, Donald Young

Virginia Commonwealth University, Richmond, VA

Barrier islands, which represent the longest collection of islands that have not been developed, provide many ecosystem services that are critical to the protection of mainlands from disturbances such as storm overwash and sea level rise. Islands and associated marshes and lagoons provide an array of habitats leading to diverse assemblages of plants, terrestrial animals, waterfowl and both fish and shellfish. Many barrier islands along the East coast of North America show evidence of human-use throughout time, especially by Native Americans; however, much of the history dated before European settlement has not been well-documented. Our study is focused on Traditional Ecological Knowledge and the Indigenous use of Virginia's barrier islands. Traditional Ecological Knowledge is the accumulation of knowledge, practice and belief about relationships between living beings in a specific ecosystem, acquired by Indigenous peoples' direct contact with the environment. It incorporates social, cultural, and spiritual systems of understanding into science, making it crucial to successfully maintain ecosystems that have been anthropogenically altered since colonization. Through record searches, surveyance of midden piles on the islands, and collaboration with Tribes along Virginia's coast, we will identify plant species historically present on the islands and what functions the land served for people of the time. This project will enhance our understanding of barrier island ecology and will ultimately demonstrate the need to incorporate Indigenous Knowledge within ecological studies and conservation.

P296 - Patterns of Gene Flow and Genetic Structure in Spider Beetles

Naiya Sims, Jarrett Johnson

Western Kentucky University, Bowling Green, KY

Spider beetles of the genus *Coleotestudus* are distributed throughout the arid and semi-arid regions in the western United States. Spider beetles are small, flightless beetles whose round bodies and long, slender legs resemble spiders. Given their small size and lack of flight, it is presumed that the dispersal capability of spider beetles is limited. Their limited vagility might be exacerbated by the harsh arid environment in which they live, leading to a prediction of strong genetic structure on a small spatial scale. Spider beetles are not a very well-known group of insects so this research can shed light on geographic patterns of genetic variation among populations and species within the genus. We used a three-enzyme restriction-site-associated DNA sequencing (3RAD) strategy to identify single nucleotide polymorphisms (SNPs) throughout the genome of three species within the genus: *C. abditus, C. giuliani, and C. ventriculus*. We used SNP genotype frequencies to describe genetic structure of populations and estimate patterns of gene flow among samples spanning the western US states of Texas, New Mexico, Arizona, California, Nevada, Colorado, and Wyoming. Our results support the hypothesis of limited dispersal ability and resulting strong genetic structure in spider beetles. From a conservation perspective, isolated populations are subject to greater risk of local extirpation, with rapidly changing global climate further increasing this risk in already harsh arid environments. Our research will help scientists understand how human and environmental influence affect spider beetle populations and their ability to maintain connectivity and genetic diversity via gene flow.

P297 - Mollusk and drill predator relationships in the Waccamaw Formation

Alessio Giammarinaro, Joseph Suddeth, Matthew Campbell

Erskine College, Due West, SC

Predator-prey relationships of extinct animals cannot be determined by conventional means because these relationships cannot be directly observed, but clues can be found by examining fossil specimens. In this experiment, ten species were sorted out of samples collected at the Whiteville quarry, NC, from the marine Waccamaw Formation. While examining fossilized shell remains of extinct mollusks, drill holes were found on some of the specimens indicating predation by Naticidae and Muricidae gastropods, and a percentage for the frequency of the drill holes was calculated for each species by dividing the number of individuals with drill holes by the total number of individuals. The ten species studied are as follows: *Glycymeris americana, Lirophora varicosa, Gouldia floridana, Anadara, Olivoidea, Cyclocardia granulata, Pleuromeris decemcosta, Prunum apicinum, Chamidae, Plicatula marginata*. After sorting and counting 5,955 individuals, 531 individuals had a drill hole for an average predation frequency of 7.60%. The species with the highest predation rate was *Lirophora varicosa* at 12.9%, while the species with the lowest predation rate was *Olivoidea* at 3.87%. *Glycymeris americana, Gouldia floridana, Cyclocardia granulata* had similar predation rates to *Lirophora varicosa* all within the 10-12% predation rate range. This could suggest that Naticidae and Muricidae sea snails prefer bivalves rather than other snails, but the correlation between the preferred bivalves requires further study.

P298 - Development of an eDNA Assay for Surveillance of the Endangered Carolina Redhorse (*Moxostoma sp. Carolina*) Fish.

Catherine Summerrow, Dominick Latta, Megan Rudock Bowman

High Point University, High Point, NC

The Carolina Redhorse, *Moxostoma sp. Carolina*, is a member of the fish family Catostomidae and a threatened species in North Carolina, according to the North Carolina Wildlife Resources Commission. It is native to North Carolina and a small part of South Carolina and protected under the Endangered Species Act. Monitoring using a catch-and-release method, with PIT tagging (where small microchips are inserted under the scales to track movement) is not efficient and may be underrepresenting the species presence. This fish is localized to the Pee Dee River, and small sections of the Haw River, and Deep River in the Cape Fear River Basin. Environmental

DNA (eDNA) may prove useful in monitoring the presence of species, both in waters where they have been previously recorded and have not yet been recorded. eDNA is any genetic material "shed" by an organism in its environment and has become more prevalent in aquatic species surveying. Species-specific PCR primers were designed using NCBI Blast, targeting a fraction of a Cytochrome b mitochondrial DNA gene. A map was created using previous surveys to assist in locating areas for initial sampling. Cartographical data is used to identify regions of interest where water samples are collected, filtered on-site, and processed through PCR and gel electrophoresis, using the primers designed. A positive result will show bands at lengths of 213 and 431 base pairs in the gel, and a negative result will show no banding, or banding at only one of the two target lengths. DNA isolated from a Carolina Redhorse fish sample will be used as a positive control and universal primers for GAPDH are used to confirm the presence of eDNA. Finally, sequencing will be used to validate the primers selected.

P299 - Detecting Historic Tar Kilns using Aerial LiDAR Derived Digital Elevation Models at Blackwater Ecological Preserve, Zuni Virginia.

Nathan Teel

Old Dominion University, Norfolk, VA

Significant declines in longleaf pine ecosystems during the past two centuries have motivated research and conservation efforts to better understand historic reference conditions. However, the historical conditions that the naval store industry had on the ecological impacts on forest structure have not been fully constructed in Virginia from 17th, 18th, and 19th century sources. We used the Tar Kiln Feature Detection workflow (TKFD), an open access, scripted, and replicable process developed in R and FIJI to identify archaeological tar kilns for the entirety of Blackwater Ecological Preserve in Zuni, Virginia. The tar kilns are within high-resolution digital elevation models derived from aerial LiDAR datasets. Results shows slope, hillshade, and Visualization for Archaeological Topography (VAT).

P300 - Preferred Habitat for Coastal Shrub Establishment on a Virginia Barrier Island

Kaitlyn Harless[1], Donald Young[2], Natasha Woods[3], Julie Zinnert[2]

[1]Virginia Commonwealth University, VA, [2]Virginia Commonwealth University, Richmond, VA, [3]Moravian University, Bethlehem, PA

Barrier islands occur along the Eastern Coast of North America and protect mainland coasts from major oceanic storms. Landscape characteristics and vegetation profiles of these islands are constantly changing in response to varying environmental drivers, especially salinity and shoreline erosion and accretion. Relationships between shrubs and other native flora can affect the island landscapes and resiliencies against storms. Hog island is a barrier island along the Eastern Shore of Virginia and is within the Virginia Coast Reserve Long-term Ecological Research site. As such, Hog Island has a well-documented history of changes in landscapes and ecosystems. Northern and southern shores of Hog Island differ, with the northern part, low elevation marsh and grassy swales transitioning to shrub thickets while the southern portion has been primarily grassland habitat. Over the last 20 years, shrubs, *Morella cerifera* and *Baccharis halimifolia*, have been encroaching towards the southern part of the island. These species are disbursed by birds and wind, respectively, and mostly in a random fashion. Our study is quantifying the spatial variations in environmental variables for Hog Island to both characterize habitat where seedlings and smaller shrubs currently exist. These variables include distance to shoreline, elevation, depth to ground water, and soil salinity, and may be coupled with remotely sensed drone imagery to identify a suite of habitat variables that promote successful establishment. As shrubs encroach into the southern grasslands and densities increase that region may shift to a community dominated by woody species, potentially leading to changes in landscape structure.

P301 - 2023 Sound Data Analytics at Hob Caw Barony (Georgetown, South Carolina)

Dr. John Quinn

Furman University, Greenville, SC

Acoustic indices allow for quantitative measurement, characterization, and comparison of soundscapes in various natural and anthropogenic landscapes. Soundscape indices can characterize daily and seasonal changes in these ecosystems to study variations that infer phenological and biological diversity. The automated extraction and collection of sound indices allows us to monitor how land change and temporal shifts impact biophony, or biological sound patterns, and anthrophony, or human produced sound patterns. This research aims to collect data relating to acoustic diversity, specifically biophony, at three sites in Hob Caw Barony. Hob Caw Barony is located on the coast of Georgetown, in South Carolina. This region contains mature pine leaf forests, new growth pine leaf forests as a result of clearcutting, and marshland landscapes. Acoustic recording units (ARUs) were deployed in sets of two at these environments to compare the variability and complexity of soundscapes at different canopy levels. A total of six automated recording units were deployed on carbon flux towers between the months of March and September. With each ARU recording at the same time, it will allow for concurrent sampling across the three study sites. The data is analyzed and visualized using RStudio Version 2023.06.2+561. This research will provide a novel data layer for the management and ecological history of Hobcaw Barony. As a preview way of illustration, the data that has been analyzed thus far shows the lowest values of biophony and the highest values of anthrophony among the saltmarsh landscape at Hob Caw Barony.

P302 - Throughfall nitrate as an indicator of dry deposition.

Nina Ravel[1], Rebecca Hale[2], Andrea Vazquez-Marrero[3], Carey Pelc[2], John Parker[2]

[1]James Madison University, Harrisonburg, VA, [2]Smithsonian Environmental Research Center, Edgewater, MD, [3]University of Puerto Rico, Río Piedras, San Juan, PR

Throughfall is the water that flows through tree canopies, coming in contact with tree leaves before reaching the ground. The interaction between the leaves and rainwater impacts the composition of the water: throughfall gains compounds deposited on leaf surfaces as well as compounds from the leaves themselves. Nitrogen is often elevated in throughfall compared to rainfall, and in excess, nitrogen can have a negative impact on surrounding waterways, causing eutrophication, harmful algal blooms and dead zones. Nitrogen in throughfall could be from atmospheric dry deposition or directly sourced from the leaves, and we expect the composition of nitrogen to reflect its source. Dry deposition is expected to have relatively high nitrate, while we expected leaching from leaves to be higher in organic nitrogen. To characterize the composition of throughfall, we measured throughfall and rainfall from two rain events at the BiodiversiTREE experiment at the Smithsonian Environmental Research Center in Edgewater, Maryland. To assess differences among tree species, we measured throughfall from six species: *Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis, Quercus pagoda, Quercus rubra and Fagus grandifolia*. Throughfall percent nitrate (35%) was greater than rainfall nitrate (25%) for the June 13th rain event, which followed a long dry period. Contrastingly, for the June 26th rain event, throughfall nitrate (10%) was much lower than rain nitrate (35%). Among species, *Liriodendron tulipifera* had higher percent dissolved organic nitrogen and lower percent ammonium compared to other species. Overall, we found that antecedent conditions likely shape the relative contribution of dry deposition and plant nitrogen to throughfall.

P303 - Spatial Mapping and Analysis of *Cambarus aff. dubius* in West Virginia with emphasis on collections in 2022-2023

Kaleb Norris[1], James A. Hartley[2], Zackary A. Graham[2], Zachary J. Loughman[2]

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The Upland Burrowing Crayfish (*Cambarus aff. dubius*) is native to West Virginia, Pennsylvania, Virginia, and Kentucky. *C aff. dubius* is a primary burrowing crayfish species which dig intricate burrows into water tables near seepage wetlands and natural springs at varying elevations. Little is known about the complete distribution of *C aff. dubius* within the state of West Virginia. Spatial distribution data regarding *C. aff. dubius* has only recently been collected for the state of West Virginia, thus emphasizing the need for updated data. Using new collection data from 2022-2023 and geographical information system (GIS) the West Liberty University Crayfish Lab created a map that provides a more complete understanding of *C aff. dubius*' geographic prevalence and ecological niche within West Virginia. Understanding the spatial dynamics of *C aff. dubius* is crucial for informed conservation strategies and resource management within West Virgnia and could be applied throughout the range of *C aff. dubius*. Furthermore, this research contributes to the broader field of species distribution modeling, showcasing the applicability of advanced spatial analysis techniques in ecological dynamics of understudied organisms.

P304 - Assessment of Landscape Changes and Stream Habitat Alteration at the Hurricane Creek Research Site in Northeast Georgia

Celia Smith, Danyelle Aganovic, Andrew Taylor

University of North Georgia, Dahlonega, GA

Hurricane Creek in Northeast Georgia converges into the headwaters of the Etowah River, a basin with high aquatic biodiversity and several protected species. The condition of the Hurricane Creek Research Site, which is owned and managed by the University of North Georgia, has the potential to influence the quality of the downstream Etowah mainstem river, potentially affecting its aquatic community. In 2017, a stream habitat assessment was conducted at the Hurricane Creek Research Site. In 2023, the same 250 m sample reach of Hurricane Creek was reassessed for physical changes in quality of the stream bed, banks, and riparian zone. An assessment of the Hurricane Creek watershed was then conducted to examine possible large-scale causes of the changes observed in the riparian zone, sediment deposition, bank stability, embeddedness, and instream cover of the study area. A model was created using ArcGIS to try and help explain the habitat assessment score changes observed between 2017 and 2023 as they might be related to landscape changes in the Hurricane Creek watershed. Impactful habitat changes were observed in the sample area and watershed that may implicate the need for restoration and preventative measures in order to protect sensitive species such as the federally endangered Etowah Darter (Etheostoma etowahae) in the Etowah River.

P305 - Effects of Hurricane Creek Water Quality on the Etowah River in Northeast Georgia

Sydney Silver, Morgan Hill, Danyelle Aganovic, Andrew Taylor

University of North Georgia, Dahlonega, GA

The Etowah River basin of Georgia is home to a biodiverse aquatic fauna, many of which are sensitive to water quality impairment. The confluence of Hurricane Creek and the Etowah River is located at the University of North Georgia's Hurricane Creek Research Site. There is a visibly noticeable overall change in water quality where Hurricane Creek meets the Etowah River. To quantify how water quality differs between the Etowah River, Hurricane Creek, and how Hurricane Creek might be influencing the Etowah River, samples were taken from Hurricane Creek as well as the Etowah River both upstream and downstream from the confluence. Samples were taken weekly for five weeks and examined. Measured parameters included temperature, turbidity, pH, dissolved oxygen, total suspended solids, alkalinity, hardness, and *E. coli* and fecal coliforms. Based on preliminary analyses, some differences in water quality were observed among the sites that warrant further investigation. Future studies will investigate potential causes for these differences in water quality such as seasonality, local construction, and agriculture.

P306 - Soil temperature differences and their relation to revegetation of ASGM sites in the Western Amazon Rainforest

Andrew Calfa

Wake Forest University, Winston Salem, NC

In recent decades, the Amazon has been plagued by an expansion of financially lucrative and ecologically destructive gold mining practices. These are typified by small, rudimentary, and easily adoptable forms of mining together termed artisanal and small-scale gold mining (ASGM). In addition to being responsible for a very large proportion of habitat loss in the Western Amazon, ASGM operations are also the single largest contributor of mercury pollution in the world. This pollution, combined with the high pressure pumps used for the sifting and sorting of the soil and its contents, transforms what was once healthy and intact rainforest into barren and toxic desert that has often proven highly resistant to revegetation. Using the mining zone of "La Pampa" in the Madre de Dios region of southeastern Peru as the focal point for this study, we used environmental data loggers to record light and temperature measurements near ground level and temperature measurements at two subsurface depths over approximately three weeks in June-July 2023 at three sites in an abandoned mining area. These sites spanned three different land-covers common within the mining area: bare soil, low herbaceous vegetation, and closed-canopy forest. The data accumulated by these HOBO sensors is further supported by geolocated temperature readings acquired using a hand-held soil temperature probe in nearby areas, as well as geomorphological maps of the sampled mining regions collected by drone-borne LiDAR. These data will show how mining and topography relate to soil temperatures and the observed presence or absence of vegetation in and near abandoned gold mines.

P307 - Impact of Wastewater Contamination on the Overall Health of Crayfish in Rural Appalachian Streams

Jonny Sweeney, Zoey Snider, Thomas Ford

Concord University, Athens, WV

We are comparing the impact of wastewater on aquatic life in rural streams in Central Appalachia. We will be measuring the overall health of crayfish in streams impaired by fecal coliforms and streams that are unimpaired. Faulty septic systems and direct pipe flow of sewage lead to high fecal coliforms in many rural waterways. According to the West Virginia Department of Environmental Protection, over 13% of streams in West Virginia are contaminated by fecal coliforms, one of the state's leading causes of stream impairment. In this study, we will monitor 4-6 streams impaired with fecal coliforms and 4-6 unimpaired streams in rural West Virginia and Virginia. Fecal coliform levels will be measured in these streams throughout the study. To examine the overall health of the crayfish in these streams we plan to extract hemolymph to measure protein concentrations and other biochemical indicators of health. Crayfish from the study streams will also be collected and behavioral assays will be used to measure stamina and aggressiveness. Tissue samples will be collected from the crayfish for analysis of their microbiome. We expect the crayfish in wastewater impacted streams to be in a lower state of health. Most research on streams contaminated by wastewater focus on urban watersheds. This study will expand our knowledge on the impacts of wastewater on the health of aquatic life in rural streams. The purpose of this poster is to get feedback on this senior undergraduate research proposal.

P308 - Ecological restoration of Pike Pond and Terry Top, New River Gorge National Park and Preserve, West Virginia

Candace Crawford, Jay Raymond

West Virginia University Institute of Technology, Beckley, WV

Undergraduate research students at West Virginia University Institute of Technology (WVUIT) conducted preliminary assessments of two proposed ecological restoration areas and their corresponding reference sites in the New River Gorge National Park and Preserve (NRGNP), West Virginia. The two proposed ecological restoration areas, Terry Top and Pike Pond, are part of a larger landscape network in the NRGNP to rehabilitate previously restored mine land areas initially stabilized by compacting soils and planting non-native, fastgrowing, invasive plant species. In 2024, these areas and others in the NRGNP will have several centimeters of existing, compacted topsoil removed to reduce the existing non-native seed bank in the soil and replaced with non-compacted soil amendments. Native plant species will also be used to stabilize the replaced topsoil. In the fall 2023, WVUIT undergraduate research students and the fall ecology course began an assessment of two proposed ecological restoration sites and two mid-successional deciduous forested sites serving as references, Terry Top forested and Grandview Pond. This research characterized common terrestrial invertebrate and plant communities during the fall (late August to mid-October). A higher soil invertebrate diversity was observed at reference sites (various mites, nematodes, spiders, springtails) compared to the proposed ecological restoration sites (mites, nematodes). Yet because the plant community of the proposed ecological restoration sites was a field dominated by fall flowering species, primarily species of goldenrod (*Solidago spp.*), the terrestrial invertebrate community contained several pollinators such as the common Eastern bumblebee (*Bombus impatiens*), Eastern honeybee (*Apis Cerana*), goldenrod soldier beetle (*Chauliognathus pensylvanicus*), and dark paper wasp (*Polistes fuscatus*). Future WVUIT undergraduate researchers, plant taxonomy and ecology classes will monitor the ecosystem restoration projects to assess their efficacy.

P309 - Establishing Baseline Values of Water Quality to Monitor Impacts of Development in a Vulnerable North Georgia Stream

Kayley Shepherd[1], Brandy Rogers[2]

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Assessing and monitoring water quality in stream systems is crucial for the long-term sustainability of aquatic ecosystems. Many factors can trigger changes in water quality, including weather, geographical location, development, and other human impacts. Stamp Creek in Bartow County, GA flows through land that has been protected as a state Wildlife Management Area since 1977. In May of 2023, landowners of the former WMA property, located off of GA-20 in Cartersville, Georgia, elected not to renew the state's lease so that plans for mining, as well as residential and commercial development, can proceed. This project aims to establish baseline water quality values for Stamp Creek so that long-term monitoring protocols for the stream can be developed. The second aim of this project is to establish Drum Creek as a control to compare to Stamp Creek over time. Drum Creek is a protected stream on the Pettit Environmental Preserve located off of GA-61 in Dallas, Georgia. For this study, we will be using water quality parameters to establish baseline values for both creeks for future monitoring once development begins.

P310 - An on campus, collaborative restoration of landfill and degraded suburban ecosystems

Talia Cartafalsa, Chelsea Peters

Roanoke College, Salem, VA

As urbanization has increased, native habitats have become increasingly fragmented in suburban areas. Habitat fragments provide fewer ecosystem services than large, intact ecosystems; however, restoration efforts can improve ecosystem services that benefit both the natural environment and the people living in the surrounding area. In this paper, a landfill and two degraded suburban ecosystems on Roanoke College's Campus in Salem, Virginia serve as a case study for an innovative on-campus, collaborative restoration in a suburban setting. Known as the Roanoke College Environment Center, this project has provided opportunities for undergraduate students, college faculty, and external community groups to participate in a number of experimental and educational restoration efforts. Presently, the Environment Center is being used as a field station for further restoration, research, and monitoring. Students have access to learning soil, ecological, and hydrologic field techniques such as soil sampling and analysis, quadrat surveys, aboveground biomass collection, and UAV imaging. It also continues to be used as a non-traditional setting for community-oriented environmental literacy events, as well as an educational space for Roanoke College classes. While outdoor classroom spaces are used on other college campuses, the Roanoke College Environment Center is novel in its mission to both restore a degraded suburban ecosystem while providing benefits to the students, to the college, and to the greater community through education.

P311 - Do habitat changes downstream of small dams have consistent effects on the performance of *Nocomis micropogon* (River Chub) and *Nothonotus rufilineatus* (Redline Darter)?

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The increasing prevalence of small dams (<5m) has altered downstream flow and sediment regimes of many low order streams, which negatively affects habitat for the biological community. Small dams may have varying effects on fishes that are dependent upon species-specific habitat associations and body plans. The objectives of this study were to quantify the effects of habitat modifications due to small dams on the body condition of two lotic fish species of the southeastern U.S.—a benthic species, *Nothonotus rufilineatus* (redline darter) and a limnetic species, *Nocomis micropogon* (river chub) using body index. Large *ex-situ* stream mesocosms were used to replicate the flow and substrate conditions in normal stream conditions and conditions typically seen below a small dam. Flow and substrate treatments were implemented in combinations to clarify which effect was stronger. We observed species-specific differences in responses to conditions mimicking habitat downstream of a small dam. *Nothonotus rufilineatus* performed best with low flow and complex substrate, while *N. micropogon* performed similarly in all treatment levels, but had the poorest performance with simple substrate and normal flow. We may infer that substrate may be the limiting factor for both species because of the way it interacts with flow. Complex substrate alters the velocity of streams and provides interstitial spaces for the benthic *N. rufilineatus*, whereas deeper, less turbulent water increases ease of movement among pools for the larger, more mobile *N. micropogon*. Although the effects of large dams on native fauna are nearly always negative, the influences of small dams on downstream biota are nuanced and dependent upon the species and magnitude of habitat change. Small modifications to dam construction protocols could restore sediment balance to downstream ecosystems and minimize the potential negative effects of flow modification.

P312 - Allochthonous leaf litter from invasive exotic plants and its effects on macroinvertebrate communities in two low-order Appalachian creeks

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Water quality is impacted by a variety of anthropogenic actions, often resulting in alteration of pH, increases in dissolved salts and metals, and increased turbidity and sedimentation. Anthropogenic activities can also facilitate the introduction and spread of invasive exotic plants such as Japanese knotweed (Reynoutria japonica), a very common riparian plant along many Appalachian streams. We sought to compare macroinvertebrate community composition between leaf packs of native and exotic riparian species. We created a control treatment from a mixture of native riparian tree species, primarily Acer saccharinum (silver maple), and an exotic species leaf pack treatment composed of R. japonica leaves. Six replicates of each leaf pack treatment were deployed for three weeks into a reference stream and an impaired stream in the Allegheny plateau. Macroinvertebrates were identified to order and differences in community compositions were analyzed. We found reduced stonefly abundance in the exotic leaf pack in the reference stream compared to the native leaf pack. Furthermore, overall macroinvertebrate abundance was severely reduced in the impaired stream compared to the reference stream.

P313 - Seasonal Variation in Water Quality Parameters on Upstream vs. Downstream Study Sites on Wheeling Creek

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Waterways in the Allegheny Plateau and Upper Ohio River Valley have a long history of significant mining, industrial, and agricultural impacts. Additionally, aging urban infrastructure and lax enforcement of straight piping and illicit discharges have led to a myriad of water quality impairments in the region. However, there have been considerable changes in industry and mining activity in the last seven decades and the regional population has steadily declined from a peak in the 1950s. More recent modernization of wastewater infrastructure has helped reduce discharges of untreated sewage into local waterways. Water quality is generally thought to have improved over the last 70 years. As such, we sought to compare water quality data from the upstream and forested section of Wheeling Creek, a 5th order creek, with a downstream more urbanized section of the creek. We compared a year's worth of summer and winter water chemistry data to assess seasonal changes as well as changes in water chemistry from upstream to downstream sites.

P314 - Reflections on Water Monitoring Strategies in the Irwin Creek Watershed of West Charlotte

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Ensuring the upkeep of urban surface waters is crucial for safeguarding public health and preserving the ecological balance of our watersheds. Urban creeks often face an array of environmental challenges that can be alleviated through proactive stewardship employing the best management practices. Johnson C. Smith University (JCSU) is in the Irwin Creek subwatershed, part of the Catawba River Basin in West Charlotte. Notably, in 1968 Irwin Creek was classified as impaired under Section 303d of the Clean Water Act In this context, we introduce the initial phase of a nascent water monitoring program for Irwin Creek initiated by JCSU's Center for Renewable Energy and Sustainability (CRES)This study presents data from probes deployed in Irwin Creek that have been collecting temperature, depth, and conductivity data since 2021. I also conducted a 3-month study of water quality at numerous locations in West Charlotte's Irwin Creek, using a handheld water quality meter, measuring for temperature, depth, conductivity, dissolved oxygen, pH, turbidity, among other parameters. During the sampling study, I also conducted bacteriological samples testing for E. coli. The probe data provides a framework for beginning to characterize patterns in the Irwin Creek Watershed over the course of time. Probe data showed variations attributable to changes in the seasons, and more acute responses to localized rain events. The bacteriological data indicates that in some instances E. coli levels are above the criteria threshold (value>>235 cfu/100 mL), indicating a biological water quality issue in Irwin Creek that can be of concern for public health. This study presents baseline data to better inform future iterations of water quality monitoring strategies in Irwin Creek. Future work includes the development of a community engagement strategy for the Beattie's Ford Road Corridor. An area which predominantly comprises African American residents

P315 - Comparison of macroinvertebrate communities between two small order tributary streams, and an assessment of overall stream health (chemical and biological) in historically impaired streams.

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Urbanization in a watershed is known to alter water chemistry and hydrology which subsequently impacts the macroinvertebrate community. Furthermore, sedimentation is often associated with human activity, such as agriculture and construction, among other sources. We sought to compare the invertebrate community between two similar small stream systems. The first site is a forested stream located at Castleman Run, a third order tributary of Buffalo Creek. The second site, Long Run, is in a highly urbanized area and is a second order tributary of Wheeling Creek.
Using water chemistry data and macroinvertebrate sampling we assessed recent trends in water quality, reported differences in macroinvertebrate communities between the two sites, and provided an overall assessment of stream health in Castleman's Run and Long Run.

P316 - Using Machine Learning for Quantifying the Spread and Identification of Aquatic Species in a Waterbody in Northeast Louisiana

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Aquatic invasive species (AIS) are a rising concern among wetland ecologists due to their adverse effects on habitat and biodiversity. Leveraging the advancement in Unmanned Aerial Vehicle (UAV) technology, we used a DJI P4 Multispectral UAV, flying at an altitude of 50m AGL and a ground sampling distance (GSD) of 2.65cm/pixel to collect the imagery from a wetland site in Northeast Louisiana, invaded by White Water Lily (Nymphaea odorata). Flights were conducted triweekly from late March, for leaf-out to early November, leaf-off season, covering a full season phenological cycle. The study aimed to achieve two objectives: 1) utilizing AI for classifying invasive species, including submerged aquatic plants, and, 2) quantifying AIS growth rates during the active growing season. While the aim was to detect and identify both floating and submerged vegetation, the results of the image analyses proved that the training data for submerged plants was unusable. Therefore, we quantified the growth rate of one species (N. odorata), that predominantly covered the lake surface area during the growing season of 2023. We used Agisoft (a photogrammetry software) to generate an orthomosaic for

training and testing data from the raw UAV imagery. Orfeo Toolbox (OTB) in the QGIS was used to develop a Machine Learning (ML) model and test and validate the data. Based on our findings, the model developed effectively identified lily pads (with 91% confidence) and monitored vegetation growth during the growing season. Our findings suggest that if effectively trained, validated, and tested (ratio = 7:2:1), such ML models can be easily adopted to further develop the early detection of proliferation of AIS including Harmful Algal Blooms (HABs), resulting in effective management and conservation efforts in wetlands

P317 - Determining the effect of estuarine water on seedling production in *Spartina alterniflora*

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Spartina alterniflora is a vital plant species in salt marsh ecosystems, playing an essential role in stabilizing marsh sediments, preventing erosion, and providing a habitat for a diverse range of wildlife. This salt-tolerant grass's ability to thrive in saline environments makes it a critical species in supporting salt marshes' biodiversity and ecological balance, and therefore is often planted as part of salt marsh restoration projects. Attempts to propagate this species from seed using traditional methods, such as winter storage and germination in tapwater, can result in low germination rates. However, seeds in natural marshes overwinter and germinate in soils that are frequently inundated by estuarine water, which may contain chemical compounds and/or microbial communities that facilitate seed germination. The purpose of this study is to investigate the effect of estuarine water on the viability and germination of seeds. To this end, seeds were collected from a natural marsh and placed under three overwintering treatments: estuarine water, which contained both chemical compounds and microbiota; autoclaved estuarine water, which contained only chemical compounds; and deionized water (control). Beginning January, we will begin germination trials of seeds under their storage treatments to assess germination rates. The results of this research will help identify mechanisms that facilitate seed viability and germination under natural conditions and facilitate the nursery production of this species for restoration by elucidating best strategies for seed propagation.

P318 - Global Scale Effects of Pollution on Parasites and Freshwater Fish Health

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With the growing increase of anthropogenic effects on freshwater environments, there is also definitive evidence of changes in physiological, distribution, and or diversity of native populations. These environmental changes pose a serious threat and there is little information and research that explores the simultaneous effects of parasites and pollutants on the host organism. The purpose of this cumulative review of many sources of literature is to explore the effects of pollution on the health of freshwater fish and their parasites on a global scale. In doing so, it would provide insights of the state of fish health and their parasites in relation to habitat changes like introduction of heavy metals, changes in abiotic factors, and increase in pollutants.

P319 - Spatial analysis of *Lumbricus spp.* distribution in West Liberty University's campus woods

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Naturalized earthworms of the genus Lumbricus are not commonly found in deciduous hardwood forests of North America but have been expanding into these areas in recent years. This is a problem because Lumbricus worms consume large amounts of leaf litter, disturbing natural soil horizons. The disruption results in damage to native plant life, seedlings specifically, by depleting the forest floor and draining nutrients necessary for growth. A monitoring project established in 2020 surveys a 900 m2 plot in WLU's campus woods community known to be inhabited by lumbricid earthworms. Weekly data collection of the area measures worm density, length, and a variety of environmental parameters. In 2023, the distribution of Lumbricus spp., in patches and gaps, was determined using the statistical method SADIE (Spatial Analysis by Distances IndicEs). Earthworm aggregations, or patches, were found to be significant in several locations. A comparison between data from 2022 and 2023 showed that while significant patches were present each year, the overall area of patches was more significant in 2023. However, the data did not show a significant spatial association of patches when comparing patch locations between the two seasons. The data indicates that the worms' range expanded, and patch locations shifted from 2022 to 2023. Additionally, while both populations endured drought conditions, a 100% increase in worm density was seen in 2023. Further observation is needed to understand and assess the full impact of Lumbricus spp. population and spatial dynamics in forested areas.

P320 - The Intersection Between Citizen Science and Academia in Water Conservation Efforts

Ariel Bishop

Erskine College, Due West, SC

Volunteers with the South Carolina Adopt-A-Stream (SC AAS) citizen science program collect baseline data instrumental in the monitoring of the baseline health of South Carolina's waterways. Following the freshwater testing protocols for water temperature, pH, dissolved oxygen, and Escherichia coli levels set forth by SC AAS, seven streams in Abbeville county were tested in the summer of 2022. As a continuation and expansion of this research, four of these streams were tested again in the summer of 2023, along with two streams in Greenwood county and a stream in Anderson county. The effects of water chemistry, especially temperature and oxygen availability, strongly influence aquatic ectotherm metabolic rate, which has effects at the individual, population, and ecosystem level. This relationship can be utilized in conservation efforts as oxygen availability and stream quality may play key roles in mitigating the

effects of global warming on aquatic life.

P321 - Impact of invasive Asian Jumping Worms on Southern Appalachian Forest Soils

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While generally lauded as beneficial for soil health, many earthworm species in North Carolina (NC) are not native and some are highly destructive. One of the most infamous groups is the Asian jumping worm (Megascolecidae), locally known as 'snake worms' or 'Alabama jumpers.' Unlike endemic burrowing earthworms, these worms live at the soil surface where they consume enormous quantities of leaf litter from the forest floor. This behavior can disrupt ecosystems, often leaving barren landscapes of castings in place of detritus, likely eliminating key habitat for other organisms including endemic and endangered animals, plants, and fungi and altering soil carbon and nutrient cycles. Asian jumping worms are a threat to NC forests; however, little is known about the extent of their impact. Here, we surveyed Asian jumping worms' abundance at in a Southern Appalachian Hardwood Forest (Appalachian State University's Nature Preserve) and assessed their impact on forest soils and their biodiversity. We found that Asian jumping worm abundance correlated with human activity, where worms were most abundant near the edge of the forest and in areas of high foot traffic on trails. Places where worms were present also lower leaf litter depth and mass, but surprisingly, no difference in soil organic matter compared to sites with no worms. The litter layer composes critical habitat for diverse organisms (including plants, animals, and microbes), and we demonstrate that Asian jumping worms also impact soil and litter invertebrate abundance and diversity. In the future, this project will expand its assessment of Asian Jumping Worm impact on Southern Appalachian Forests.

P322 - Exploring Acetylcholinesterase Expression and Activity in *Crassostrea virginica* along the Georgia Coast

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As filter feeders, oysters may accumulate contaminants and are commonly used as a food source and to assess the health and safety of an environment. Georgia is making an effort to develop a viable mariculture industry. Therefore, the purpose of our study is to develop a baseline assessment of the health of oyster populations along the Georgia coast. Commonly used bivalve biomarkers include the measurement of acetylcholinesterase (AChE) expression and activity. We collected oysters (*Crassostrea virginica*) from four sampling sites on the Georgia coast. Gill tissues were extracted and stored in liquid nitrogen prior to processing. To assess expression, AChE specific primers were validated using real-time PCR techniques. We will quantify relative AChE mRNA levels from our sampling sites. Insoluble and soluble proteins were also isolated from gill tissues, quantified by a Bradford protein assay, and AChE activity was measured using Ellman's assay. Many studies fail to characterize AChE activity from soluble and insoluble fractions, which is important since environmental conditions may differentially regulate activity of specific fractions. While total activity is consistent among all sites, the relative activity ratio between the insoluble and soluble fractions varied among sites. Future directions include surveying AChE expression and activity at additional sampling site locations and in differing hydrographic conditions, in conjunction with other measures of oyster health, and in other oyster tissues. Taken together, these data provide an invaluable resource to coastal managers and scientists for both economic and environmental decisions.

P323 - Characterizing the role of the Sphingosine 1-phosphate pathway in post-traumatic fibrosis

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Following injury, tissue repair allows for the restoration of the architecture and function of the injured tissue, while tissue replacement is characterized by severely damaged or non-regenerable tissue that is repaired by the laying down of extensive connective tissue, also known as fibrosis. The fibrotic process must be arrested at its early stage to have the greatest impact on preventing or reversing associate sequelae and promoting the regeneration of normal tissue. Sphingosine 1-phosphate (S1P), a metabolic product of cell membrane sphingolipids, has recently emerged as a potential pathway involved in fibrosis. Most of S1P's actions are mediated through the five G protein-coupled S1P receptors (*S1PR 1–5)* that respond to extracellular S1P to regulate multiple cellular processes. Here we used *in vitro* models to characterize S1P in injury and post-traumatic fibrosis. We hypothesized that the S1P-*S1PR* axis plays a role in the formation of fibrosis after injury. To test our hypothesis the *in vitro* models used human bone-marrow mesenchymal stem cells (BM-MSCs) treated with transforming growth factor beta-1 (TGFβ1) for 24 hours to mimic injury or to induce the formation of fibrotic nodules. Quantitative PCR (qPCR) was used to investigate the expression levels of S1PRs and *GAPDH* was used as a housekeeping gene. Overall, we predict that the S1PRs play a role after injury and in the formation of fibrosis. Altogether, our results provide novel insights in the role of S1P during human post-traumatic fibrotic formation and suggest that the S1P pathway may be a potential target in the prevention and/or treatment of fibrotic formation after injury.

P324 - Identification of sea turtle species utilizing tissues recovered from predated nest at a novel nesting location

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Sea turtles return to the same nesting grounds each year but due to climate change and anthropogenic development are forced to find

novel nesting sites. A depredated sea turtle nest was found at a previously unknown nesting site in Alabama in the summer of 2019. Based on the reproductive biology and natural history of turtle species inhabiting the region, this nest is most likely to have been one of three species known to inhabit the Northern Gulf of Mexico: Loggerhead, Kemp's Ridley, or Green. Predation left limited evidence: size/depth of the nest, number of eggs, and empty eggshells, that could determine turtle identification. Genomic DNA extraction from these eggshells returned low yieldsfor multiple reasons including limited amounts of DNA found within eggshells as well as the storage conditions of samples prior to extraction. Isolation required use of liquid nitrogen and an extended incubation in lysis buffer to maximize yield. DNA was then amplified with a series of primer sets. Primers specific to Kemp's Ridley Sea turtle (*Lepidochelys kempii*, Garman 1880) provided species identification.

P325 - Vorniostat on the Expression of TGF-ß and TGIFs in Murine Subcutaneous Fibroblasts

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In injured tissues, the Smad pathways work in a tightly regulated and controlled manner to repair the resulting damage, forming a scar. Scars normally do not allow for full return of elasticity and mechanical function. However, in individuals with physiologic abnormalities that interrupt the Smad pathways, this process can become uncontrolled and inefficient. In the case of individuals experiencing a hyperexpression of Transforming Growth Factor - Beta (Tgf-β), the deposition of extracellular matrix (ECM) components is delayed to a certain point at which deposition becomes excessive. The excess of ECM components in a scar significantly reduces the opportunity for the tissue to return to an average elasticity and decreases the mechanical integrity of the tissue. The resulting scars also cause a high level of pain in those affected. Previous work has identified the histone deacetylase (HDAC) inhibitor, Vorinostat, as a potential method to regulate Tgf-β expression in the Smad pathways by increasing the expression of (TGIFs), forms of Smad pathway co-repressors, in individuals at high risk for hypertrophic and keloid scar formation. Using the LMTK cell line, a line of murine subcutaneous fibroblasts, the effect of Vorinostat on Tgf-β and TGIF expression as well as cell proliferation was assessed. Based on previous studies, by comparing test groups of a low-dose and high-dose of Vorinostat to a control over a period of 72 hours, it is expected that we will find Vorinostat to have significantly decreased the expression of Tgf-β and increased the expression of TGIF-1 and TGIF-2, while also decreasing the rate of proliferation in the LMTK cells. These findings suggest that further investigation of Vorinostat in the cells involved in tissue healing processes could lead to a better understanding of the Smad pathways and opportunities for more comprehensive treatment options for those at high-risk of abnormal scar formation.

P326 - Combining molecular analyses with morphology to identify zoantharians located at Toco, Trinidad, southernmost region of the Caribbean Sea

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Annual coral reef surveys record cnidarian and invertebrate abundance off the northeastern coast of Toco, Trinidad. However, some species are difficult to accurately identify due to morphological characteristics. One such species are zoantharians, specifically *Zoanthus* spp. therefore molecular analyses using barcoding techniques were used in this study to gain a more comprehensive understanding of zoantharian diversity. Samples were collected at 3 sites: Saline Bay (SB), Pequelle Bay (PB), and Grande L'Anse (GLA) where zoantharian coverage were widely distributed. Mitochondrial cytochrome oxidase subunit I (mt COI) identified specimens as *Z. pulchellus* and *Z. sociatus*. Specimens sequenced for the mitochondrial 16S rDNA marker added *Z.* aff. *pulchellus*. Future reef monitoring and molecular analyses will continue to add knowledge on the species biodiversity, as trends in climate change continues to dynamically change marine habitat.

P327 - Detecting LINC Complex and Nuclear Pore Complex Ndj1 Protein Interactions on Yeast Nuclear Membrane by Fluorescence Microscopy

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Though cancer cells have been shown to have abnormal nuclear morphologies and responses to mechanical forces, the mechanisms of how mechanical stress is translated into cellular action and structural reorganization within the nuclear envelope are largely unexplored. The Linker of Nucleoskeleton and Cytoskeleton (LINC) complex is a transmembrane protein complex that connects the actin cytoskeleton to the lamin nucleoskeleton, enabling mechanical forces to be translated between the cytoplasm and the nucleus. In cells exposed to uniaxial cyclic stretch, nuclear pore complexes (NPCs) – which control the exchange of biochemical signals and macromolecules in and out of the nucleus through mRNA export – have been shown to colocalize with LINC complexes. Confirming the existence of interactions between NPC and LINC proteins would establish a better comprehension of the translation of physical forces into cell responses. An interaction between NPC inner nuclear envelope proteins and Ndj1 in the LINC complex was determined by transforming sequences for Venus split-green fluorescent protein (GFP) yeast cell genomes, tagging NPC and LINC proteins. After the split-GFP proteins were integrated into yeast DNA, tagging Ndj1, fluorescent microscopy was performed to determine the level and locations of protein-protein interactions. Gel electrophoresis results showed that the Ndj1-VC DNA was transformed into the yeast models. In the fluorescent microscopy of yeast tagged with Ndj1-VC, many cells fluoresced, but there was no clear localization around the nuclear envelope. However, there were issues with the fluorescent microscopy for the positive control of yeast already producing Venus split-GFP, so no conclusive results can be made about the Ndj1 fluorescence images until the control is properly completed. Future directions include improving the positive control, and creating environments with mechanical and chemical stimuli to trigger the colocalization of NPC's and LINC complexes through which interactions are more likely to be detected in the fluorescence microscopy.

P328 - Using DNA barcoding techniques to identify shallow-water zooxanthellate zoantharians (Cnidaria: Hexacorallia) along the north-eastern coast of Toco, Trinidad

Hannah Oliver, Stanton Belford

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Zooxanthellate zoantharians form dense mats at intertidal reefs along the northeastern coast of Toco, Trinidad. Although these cnidarians thrive in nutrient-poor shallow waters of marine habitat, changing habitat and increased anthropogenic effects, may result in dynamic benthic coverage of coral reef components, which are essential to determine biodiversity on coral reefs. One species that is most commonly found on Caribbean reefs are zoantharians. Although zoantharians are visibly difficult to accurately identify, molecular analyses using barcoding techniques present one method to assist in accurately determining species. Past studies in this region are only now identifying two species of *Palythoa*. This study utilized DNA markers, specifically mitochondrial cytochrome oxidase subunit I (COI), and mitochondrial 16S ribosomal DNA (mt 16S rDNA) for samples collected at three sites: Grande L'Anse, Pequelle, and Saline Bays along the northeastern coast of Toco, Trinidad. A total 1-2 polyps were used to extract DNA from these cnidarians. Results showed that *Palythoa caribaeorum* and *Palythoa caribaeorum* were common zoantharians observed at sites. Understanding diversity of zooxanthellate cnidarians, through accurate species identification may highlight dynamic species abundance and distribution as trending environmental changes continue.

P329 - Testing SSA4:ADE3 Reporters for MCS Screening

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In eukaryotic cells, after transcription, mRNA is escorted from the nucleus to the cytoplasm to be translated. This process, called mRNA export, is essential for gene expression. However, when the cell exists in stressful conditions, mRNA export becomes regulated, and only select transcripts, including the stress-responsive SSA4 mRNA, can be exported. This project aims to uncover the mechanism of selective SSA4 mRNA export by generating a reporter that enables phenotypically visible expression under stressful conditions. Specifically, the ADE3 ORF was placed under the regulatory sequence of SSA4, which was anticipated to induce a red color for colonies only following stress. Using these reporters, mutant yeast strains were heat shocked to observe if there was a color change from white to red, indicating successful induction and export of the SSA4 mRNA. We have found that different media conditions reduce background expression of the SSA4 reporter, but do not allow stress-induced expression. From this, a CRISPR-based approach was adopted to reduce leaky expression and allow for direct integration of the SSA4 reporter plasmids. A series of integrated strains were successfully generated, and current studies will be aimed at testing these strains. Once conditions are found using the mutant yeast strains with the integrated reporters, where expression is enabled only when the yeast is under stress, a Multicopy Suppression Screen can be conducted to identify factors involved in selective SSA4 export.

P330 - Genetic analysis of a pantropical sea urchin at the southeastern edge of a Caribbean population

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Sea urchins have an important ecological role on coral reefs. As part of an ongoing study of marine biodiversity of threatened coral reefs along the northeastern coast of Trinidad, we have initiated a molecular study of the rock-boring sea urchin *Echinometra lucunter* that is present there. Molecular phylogenetic relationships of sea urchins in the genus *Echinometra* have been studied throughout the Atlantic and Indo-West Pacific regions, however, molecular data for extreme northern and southern parts of the Caribbean is lacking. This study focuses on sequencing part of the cytochrome oxidase subunit I (COI) gene in *E. lucunter* to verify species identification and to compare genetics in specimens from two regions: Big Pine Key, Florida, just north of the Caribbean Sea, and at the southernmost part of the Caribbean Sea, Toco, Trinidad. These sequences are being compared with those of Caribbean *E. lucunter* specimens from multiple sites in the Caribbean Sea and Atlantic Ocean (see accession nos. AF255468-AF255540). Results show *E. lucunter* living at the edge of the Caribbean and Atlantic belong to either one of these distinct populations.

P331 - IBA metabolism in *Arabidopsis thaliana* mutants: the potential peroxisomal function of a ubiquitin-conjugating enzyme

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Preliminary data suggest that Arabidopsis thaliana (Arabidopsis) plants containing a knock-out mutation of a gene encoding a specific ubiquitin-conjugating enzyme (UBC) display increased rates of β-oxidation, a function associated with peroxisomes. This is evidenced by a greater reduction in root lengths of the mutants as compared to wild-type plants upon exposure of the seedlings to indole-3-butyric acid (IBA), an inactive form of auxin, which is then transformed through β-oxidation into indole-3-acetic acid (IAA), an active form of auxin that controls root length. The overall focus of this experiment was to investigate whether UBC functions within peroxisomes in Arabidopsis. To achieve this, wild-type and mutant Arabidopsis seedlings were grown vertically on plates containing agar-based growth media, with or without IBA or IAA supplementation. Upon reaching the 7-day-old seedling stage, each plate was photographed, and

root lengths were measured with software analysis tools. Ratios of untreated to IBA-treated root lengths of either allelic mutant (1.77 and 1.57 for ubc-1 and ubc-2, respectively) demonstrated a difference when compared to wild-type (1.48). However, more experimental replicates are required to determine if the ratios represent a statistically significant difference. Overall, the results of this study support the hypothesis that both mutants are superior at performing β-oxidation as compared to wild-type plants, which suggests that at least one potential function of UBC is to inhibit β-oxidation and that UBC may function in the peroxisomes of Arabidopsis.

P332 - Establishment of a non-invasive method for the measurement of water-borne corticosterone in conservation efforts of imperiled species of newts

Allison Post, Holly Racine

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Wildlife endocrinology monitors hormones to assess the impacts of stressors on wildlife populations. Studies include investigating how stress affects the welfare and reproduction of at-risk species. Measuring water-borne stress hormones, or glucocorticoids, has been validated as a non-invasive method for accurately quantifying stress in a variety of species. It has previously been shown that higher levels of corticosterone, the primary glucocorticoid identified in amphibians, can be detected within hours following a stressful event. The goal of this study was to quantify corticosterone levels in water-borne samples from the Orianne Center for Indigo Conservation (OCIC) Striped Newt (*Notophthalmus perstriatus*) population to assess their ability to cope with stressors and improve captive-breeding efforts to better conserve them.

Our methodology of corticosterone quantification from water-borne samples was first tested in a population of Emperor Spotted Newts (*Neurergus kaiseri*). Water samples were collected for testing from 6 group housed individuals. Corticosterone collection was successfully accomplished using C18 solid phase extraction columns under vacuum pressure with distilled water and HPLC-grade methanol. They were then eluted with methanol under positive pressure and extracts were quantified using an ELISA kit (Arbor Assays). Following this effective methodology, we collected water samples from 7 individually housed Striped Newts at the OCIC. Samples were collected prior to handling, and then every 60 minutes for three hours after handling.

Ultimately, the results were inconclusive. However, the methodology was shown to be effective for extracting and analyzing water-borne steroids, and efforts will continue to establish a stress baseline for the Striped Newt.

Acknowledgment of NASA West Virginia Space Grant Consortium.

P333 - Analysis of the glutathione reductase gene of a Tubificid worm living in the high-sulfide-concentration waters of Blount Springs, Blount County, AL

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A population of the Tubificid species group Limnodrilus hoffmeisteri living in what should be toxic sulfide concentrations in Blount Springs, AL, was discovered in 2016. Since no other members of this species group live in high sulfide waters and the nearest reported member is in Illinois, this worm represents both a habitat and range extension for the L. hoffmeisteri group. The Blount Springs (BSp) worm is mostly like a member of clade III of this species group. Last year, the complete transcriptome was determined for the BSp worm in order to investigate genes that might be involved in its sulfur tolerance. This study reports on the characterization of the glutathione reductase (GR) gene in the BSp worm. Using primers designed from the GR cDNA sequence, we PCR-amplified and sequenced an approximately 450 nt segment of the GR gene from the BSp worm as well as from clade III worms from Illinois, U.S.A. and from Belgium. In this study we report the sequence of the 5' end of the GR gene, including the entire first intron. We also present a phylogenetic tree showing the relationship of the BSp worm to the other clade III worms.

P334 - Carry-Over Effects of Climate on Prothonotary Warbler (*Protonotaria citrea*) Feather Quality

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Avian species have inspired numerous studies on ornamentation, exploring its role in intra- and intersexual selection as a marker for individual quality. Male birds have been the focus of most of these studies when females, which can also display ornamentation, have been largely ignored. Coloration achieved through molt, particularly carotenoid-based pigments, requires energy derived from food resources. As climate affects insect abundance, there may be a link between climate during molt and feather quality the following season. We assessed the relationship between climate conditions during molt (July and August) and female Prothonotary Warbler (Protonotaria citrea) breast and crown feather reflectance metrics the following year. We collected 448 breast feather samples and 417 crown feather samples across 13 years (2010-2023) in eastern Virginia, USA. Breast and crown carotenoid content and breast yellow intensity tended to be higher following cooler and wetter conditions during molt. The negative impact of temperature on breast yellow intensity was greater in younger females. These results indicate that temperature and precipitation during molt carry over to influence female feather quality which likely serves as an indicator of individual quality to potential mates. These results provide insight into how climate conditions affect individual plumage quality and may aid in understanding the impacts of climate change on mating systems. Future study is needed to explore how conditions during molt may interact with species' thermoneutral zones to influence energy tradeoffs toward important events in a species' annual cycle.

P335 - Antioxidants as a Therapeutic for San Fillipo Syndrome

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San Fillipo syndrome is a rare pediatric autosomal recessive disorder that affects the brain and spinal cord. Patients are typically born without symptoms and then progressively lose motor function, memory recall, and experience behavioral regressions.This disorder is caused by mutations in four separate genes (SGSH, NAGLU, HGSNAT, and GNS) leading to dysfunction of enzymes involved in the metabolism of glycosaminoglycans (GAGs). As such, GAGs accumulate in lysosomes, thereby inhibiting them. One key lysosomal function that is impaired in San Fillipo Syndrome is mitophagy, which is the clearing of dead mitochondrial fragments. ROS species are often released from mitochondrial fragments, which ultimately results in cell death via apoptosis. We hypothesized that strong antioxidant supplements such as vitamin E, coenzyme Q10, astaxanthin, and vitamin C may mitigate the effects of increased mitochondrial fragments build up in the lysosome. To test our hypothesis, we induced San Fillipo with PuGNAC in COS-7 cells and treated them with vitamin E, coenzyme Q10, astaxanthin, and vitamin C to see changes in mitochondrial activity and cell viability.

P336 - Influence of phylogeny, climate, and soil properties on evolution of autumn leaf color in North American oaks

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North American oaks (Quercus L.) exhibit a range of autumn colors, including yellow, red, and various shades of orange. Still other oak species are evergreen. Orange and red colors are the result of anthocyanins, which have been shown to function in photoprotection. We hypothesized that red autumn leaves would be most common under conditions associated with high-light stress, e.g., cold minimum temperatures, low soil nutrients, and/or low precipitation. A possible phylogenetic influence on autumn leaf color was tested by running a phylogenetic contrast in R studio, using a recently-published phylogeny of North American oaks. Maxent presence-only prediction analysis in ArcGIS Pro analysis is currently underway. Preliminary analyses are consistent with our hypothesis, and suggest that yellow and orange species are more likely to occur in regions with high precipitation, while evergreens are more likely to occur in regions with mild winters.

P337 - Pinpointing a Problematic Polyploid: Mapping Cogongrass Ploidy Throughout the Invaded Range

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Cogongrass (Imperata cylindrica) is one of the worst invasive plants impacting the southeastern United States, where it threatens native biodiversity and economic productivity by forming dense monocultures, altering fire behavior and regimes, and is a major obstacle to restoration and afforestation efforts. Unlike many invasive plants that only have one ploidy level in the invaded range, cogongrass has been shown to have high levels of genetic diversity and has been found to be variable in ploidy, including diploid, triploid, or tetraploid in the invaded range of the southeastern United States. The effectiveness of cogongrass management could be variable due to cogongrass ploidy level; however, only preliminary research has been conducted to assess ploidy levels. The potential impact regarding the spatial distribution or ecological implications of variable ploidy on its spread and management has yet to be studied. Microsatellites have been successfully used to identify ploidy in other plants, but microsatellites have not yet been tested for ploidy identification in cogongrass. This study investigates potential use of microsatellite markers to map the spatial distribution of cogongrass's variable ploidy in the invaded ranges. Preliminary results from this study will be presented and discussed. We predict that microsatellite markers will be capable of detecting ploidy in cogongrass, and we will use accessions with known ploidy levels previously determined by flow cytometry and squashes of meristematic tissues to test accuracy of these microsatellite markers. Understanding ploidy distribution may help target and refine control efforts by identifying populations that have higher or a diversity of ploidy levels and thus may possess higher genetic diversity, and therefore, adaptive capacity, which could increase the likelihood of invasion success or resistance to management.

P338 - The "red island" effect: Why do some plants synthesize anthocyanins around foliar pathogens?

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Red leaf spots commonly accompany pathogen infection in plants. Yet, the function of red anthocyanins pigments in infected tissues is unknown. We characterized biochemical responses of two plant species, red-tip photinia (*Photinia glabra*) and Indian hawthorn (*Rhaphiolepis indica*), to infection by the pathogenic fungus, *Entomosporium mespili*. We used analytical HPLC and LC-MS to identify and quantify anthocyanins and photopigments in red leaves or tissues (including red expanding leaves, red senescing leaves, and red spots) and green tissues (green areas around red spots, fully-expanded green leaves) of the same plants. Maximum quantum yield efficiency of PSII (*Fv/Fm*) and xanthophyll cycle pigment ratios was measured as a proxy for sustained high-light stress. DPPH radical scavenging assay assessed low molecular weight activity (LMWA) in red spots versus surrounding green tissues. The major anthocyanins in red tissues of both species were cyanidin-3-*O*-galactoside and cyanidin-3-*O*-arabinoside. Red tissues of photinia also contained small amounts of three additional cyanidin mono-glycosides (cyanidin-3-*O*-glucoside and two unidentified cyanidin-*O*-pentosides); red spots lacked cyanidin-3-*O*-arabinoside. All red tissues had significantly lower chlorophyll and *Fv/Fm* than green tissues,

suggesting increased vulnerability to photo-oxidative stress. Photoprotective carotenoid content did not differ between red and green tissues, although this was likely due to a small sample size. Antioxidant activity was 1.5-3.4x higher in red spots versus surrounding green tissues; follow up assays with purified anthocyanins suggested anthocyanins were responsible for ca. 1/3 antioxidant activity in red spots. From these results, we predict the function of anthocyanins in red spots is similar to anthocyanins in young and senescing leaves, and this function likely includes photoprotection (i.e. light attenuation and antioxidant defense). We are currently investigating an anti-microbial function by culturing *Entomosporium mespili* in water agar plates treated with cyanidin-3-*O*-galactoside.

P339 - How Collagen Mutant Genotypes Links to Body Morphology Phenotypes in *Caenorhabditis elegans*

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Collagen comprises 25% of the dry protein weight in the human body; it is integral in the formation of bones, muscles, and connective tissues. Mutations in collagen genes are the cause of various human genetic disorders, such as Ehlers-Danlos Syndrome (EDS). EDS results in severe comorbidities affecting the elasticity of the skin and joints and can lead to severe conditions such as aortic dissection. In addition to the effects of haploinsufficiency, the formation of the collagen molecule could play a direct role in causing disease phenotypes; therefore, it is of utmost importance to understand the connection between genotype and phenotype during collagen assembly. This research aims to understand the link between specific types of collagen mutations and their phenotype by studying the *dpy-7* collagen gene in the roundworm nematode *Caenorhabditis elegans*. *C. elegans* is a simple genetic model organism and we use it to study how collagen mutations affect worm body morphology. To investigate the effects of collagen mutation on *C. elegans* body morphology, we used scanning electron microscopy to visualize the cuticle of 5 different mutant alleles of *dpy-7*. Here, we present evidence that the location of the mutation affects collagen protein structure which leads to severe changes in cuticle ring size. Ultimately, we hope to gain a better understanding of how small alterations on the genomic level can lead to large differences across the organism.

P340 - Exploring Salamander Community Diversity in GA Streams Through DNA barcoding

Allison Vessell

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Salamanders play a crucial role in maintaining ecosystem health, particularly in stream environments where they serve as indicators of habitat quality and biodiversity. This research project aims to employ DNA barcoding techniques to address salamander species diversity and abundance in selected local streams. DNA barcoding in amphibians involves sequencing standardized regions of the mitochondrial genome, which can be compared to published gene sequences to facilitate the identification of juvenile and larval salamanders. Tissue samples were collected from salamanders in three different stream habitats in Paulding and Bartow counties in Georgia. As part of our study, we explored primer suitability for amphibian DNA barcoding. As part of the ongoing debate surrounding ideal standard markers, we offer experimental findings on the relative success of 16S and CO1 primers for the identification of amphibian larval stages. The outcomes of this project will provide critical information for conservation efforts, helping to identify key areas for preservation and management. By establishing a baseline understanding of salamander community diversity in streams, this project contributes to the broader field of biodiversity conservation and underscores the importance of incorporating genetic data into ecological studies for a more holistic conservation strategy.

P341 - Disentangling the Role of the Second Messenger c-di-AMP in the Stress Response of *Staphylococcus aureus*

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The pathogen *Staphylococcus aureus* is responsible for the majority of skin and soft tissue infections (SSTIs) in humans, and can lead to sepsis and death. The immune response to infection includes induction of nitric oxide (NO·), a membrane permeable radical which binds to metals in the electron transport chain and can inhibit respiration. Nitric oxide stress in bacteria also leads to degradation of lipid biosynthesis, damage to chromosomal integrity, and disrupted metabolic enzymes. *S. aureus*, however, continues to replicate in the presence of NO· and respiratory stress. We hypothesize that second messenger signaling pathways may be involved in the unique response of *S. aureus* to NO· stress. In the presence of oxygen, elevated levels of the second messenger cyclic di-adenylate monophosphate (c-di-AMP) correlate with greater reactive oxygen species (ROS) generation. Because ROS are potentiated by NO· stress and are one mechanism of NO· toxicity, we hypothesized that c-di-AMP signaling is integrated with the NO· stress response as well. C-di-AMP is synthesized from two ATP molecules by an adenylate cyclase (DacA) and is degraded by phosphodiesterase GdpP; both enzymes are essential in the growth and fitness of *S. aureus*. Here, we show that overexpression of *dacA*, which increased c-di-AMP levels,inhibited growth of *S. aureus* and was toxic during NO· stress. Interestingly, overexpression of GdpP failed to decrease c-di-AMP levels as expected, perhaps due to a feedback inhibition mechanism. Based on these preliminary data, it is clear that c-di-AMP plays a major role during stress in *S. aureus*. Ongoing experiments aim to elucidate the specific regulatory role of c-di-AMP and design an alternate strategy for decreasing c-di-AMP levels via DacA knockdown. Ultimately, determining the essential processes utilized by *S. aureus* to survive in sub-optimal conditions will lay a foundation for the development of drugs to target these mechanisms and attenuate virulence.

P342 - Variation in the scale of spatial dispersion in *Asarum arifolium* in Autauga county Alabama: Preliminary investigations and future goals

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A population of *Asarum arifolium* (Aristolochiaceae) in Autauga County, near Prattville, Alabama was surveyed to assess the spatial dispersion of individuals at various spatial scales. Individuals were hyperdispersed (uniformly distributed) at a 1m scale, randomly dispersed at a 2m scale, and clumped at 3m and 4m scales.

A. arifolium inhabits the forest floor of deciduous forests in the southeastern U.S. Reproduction is principally via seed. (Gonzalez 1972). Seed dispersal is via myrmecochory. In Georgia, ants in the Genus *Aphaenogaster* are the primary dispersers accounting for 71% of dispersal events. (Giladi 2004) *Aphaenogaster* ants are present within the study area (J. Daniels, pers obs).

Departures from random spatial dispersion typically result from microhabitat requirements; in the case of clumping, and biological interactions; in the case of hyperdispersion. Given the size and growth habit of *A. arifolium*, its clumped distribution at the 3m & 4m scale does not give us much pause. It likely matches some critical environmental variation within the study area. Of more interest is the pattern of hyperdispersion at the 1m scale.

In the Georgia population, Giladi (2004) identified two potential factors that could account for this pattern. First, most (more than 90%) of the seed dispersal events were distances of less than one meter, and, secondly, the diameter of the root system of *A. arifolium* never exceeded 30 cm. Is either of these mechanisms (seed dispersal or intra-specific root competition) adequate to account for the pattern of hyperdispersion seen in this population of *A. arifolium*? To answer these questions, we will be examining survival of seedlings as a function of both plant density and distance to nearest neighbors in order to assess the seed dispersal effect; and survival of all growth stages (as identified by Giladi 2004) in order to assess potential below ground intra-specific competition.

P343 - Isolating Antibiotics: Assessing the antibiotic potential of the External Microbiome of *Solenopsis invicta*

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Campbell University, Buies Creek, NC

This study explores the potential for antibiotic producing bacteria in the external microbiome of the invasive fire ant species *Solenopsis invicta.* Microbes were isolated from the exterior of the ants collected from a single mound and then screened for antimicrobial activity. Six isolates that showed inhibition of numerous bacterial test strains, were identified using 16s rDNA sequencing and phenotypic testing. Thus far, putative identifications of isolates include *Burkholderia* sp., *Lelliottia* sp., *Rhodococcus erythropolis* and *Serratia surfactantfaciens.* Ongoing additional genotypic and phenotypic testing will help confirm species identity. Methods for chemical extraction of the antimicrobials will be explored and extracts will be tested against bacterial test strains. This investigation contributes towards characterizing external microbes found on *Solenopsis invicta* providing further insight into their invasiveness as well as discovering new antimicrobials.

P344 - Spatial and Population Dynamics of Invasive Pheretimoid Earthworms in West Liberty University's Campus Woods

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The eastern United States is undergoing a wave of invasion by East Asian pheretimoid earthworms. The genus *Amynthas* is particularly prolific among them, with a widespread, continuously expanding range in North America and ecosystem-wide influences. Invasive populations tend to reach extreme population densities and fluctuate heavily in weekly, and up to yearly, timeframes. Gaining a deeper understanding of the dynamics by which populations spread or grow may be of great importance to developing effective management practices. Research was conducted in the summer of 2023 in an area of West Liberty's campus woods invaded by pheretimoids, presumably *Amynthas*, for several years. SADIE spatial analysis was used weekly to visualize the pheretimoid's distribution and showed clustered distributions (Ia > 1) in 5 of 7 survey weeks, 3 of which were significantly clustered (p-values < 0.05). Linear regression and multiple linear regression showed that none of the environmental variables measured were significant (p-value < 0.05) more than 1 out of 7 weeks. Principle component analysis could only explain 18.1% of the variance in earthworm density at its highest during any survey week. When compared to data from the previous summer, the average density of *Amynthas* declined approximately 96%. Our results do not indicate why the decline occurred and cannot explain the patterns of distribution, though low densities may weaken statistical analysis. Research in 2024 will continue surveying and expand the environmental variables being measured to create a better understanding of the dynamics at work in invasive worm populations.

P345 - Assessing Biofilm Formation of *S. sanguinis* and Examining the Role of pH on Biofilm Formation

Sarah Grace, Michelle Thomas

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Many bacterial species are known to form an organized community that can adhere to surfaces, known as a biofilm. *S. sanguinis* is one of the most common species of bacteria found in the oral biofilm better known as dental plaque and is thought to be a pioneering species

whose colonization aids in the attachment of other microorganisms. *S. sanguinis* causes endocarditis if it enters the bloodstream, but does not seem to cause caries or other oral diseases. However, assessing the impacts that pH has on biofilm formation will provide insight into oral pathology as *S. sanguinis* plays a large role in the colonization of other bacterial species. To create a biofilm, a 24-well plate was used to inoculate a 22-hour culture of *S. sanguinis* in BHI broth and BHI broth supplemented with 1% sucrose. After 48 hours of growth, a crystal violet assay was performed to assess biofilm formation. A 0.01% crystal violet solution was used for the assay and a spectrophotometer was used to measure the absorbance values. The first experiment used both a pipet and decant method for the crystal violet assay to determine which method yielded more accurate results. The results indicate that the methods used were successful for creating a biofilm and that the decant method for the crystal violet assay worked better for analyzing the biofilm formation. Additionally, *S. sanguinis* had greater growth in BHI broth supplemented with sucrose compared to BHI broth with no supplement. This information proves that this procedure is effective and can be used for further research on *S. sanguinis* and examining the effects of pH on biofilm formation.

P346 - An Introduction to Population studies of Bats in West Virginia State Parks, Forests, and National Parks

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North American microbats perform copious amounts of work in their ecological niches in order to keep our native environment running smoothly. All species found in West Virginia are insectivores that are key in keeping insect populations from rising above the ecosystem's carrying capacity. West Virginia is currently lacking in updated population studies of these animals, with multiple endangered species such as the Northern Long-Eared Bat *(Myotis septentrionalis)*, Gray Bat *(Myotis grisescens)*, Virginia Big-eared Bat *(Corynorhinus townsendii virginianus)*, Small-Footed Bat *(Myotis leibii)*, and Indiana Bat *(Myotis sodalis)*. It is crucial to keep an eye on the populations and ecological ranges of these species. However, endangered species are not the only ones of importance. West Virginia has 15 total recorded bat species. Excluding the aforementioned 5 endangered species, the other 10 native West Virginian species include: Big Brown Bat *(Eptesicus fuscus)*, Silver-Haired Bat *(Lasionycteris noctivagans)*, Eastern Red Bat *(Lasiurus borealis)*, Rafinesque's Big-Eared Bat *(Corynorhinus rafinesquii)*, Little Brown Bat *(Myotis lucifugus)*, Eastern Pipistrelle *(Perimyotis subflavus)*, Hoary Bat *(Lasiurus cinereus)*, Evening Bat *(Nycticeius humeralis)*, Townsend's Big-Eared Bat *(Corynorhinus townsendii)*, and the Seminole Bat *(Lasiurus seminolus)*. While these 10 species are not currently at risk, human interference and the fungal infection White Nose Syndrome *(Pseudogymnoascus destructans)* pose a constant threat to population sizes. The purpose of this research is to provide more accurate, updated range maps in order to track future populations of all native West Virginian bat species. Data within this study has been strictly taken in only West Virginia State Parks, State Forests, and National Parks to ensure that the habitats were kept as undisturbed as possible, generating an understanding of populations in their natural habitats.

P347 - Identification of the antimicrobial activity of anthocyanins toward the plant pathogen *Xanthomonas campestris*

Madison Prendergast, Dinene Crater

High Point University, High Point, NC

Xanthomonas campestris is a known plant pathogen, in which colored spots form on the leaves of plants, as well as on many different agricultural crops. The spots caused by Xanthomonas are composed of anthocyanins, a water-soluble pigment with different coloration on the plant depending on the pH. One characteristic of anthocyanins is that they can function as antimicrobial agents. It is unknown whether the coloration found in plants infected with Xanthomonas is caused by the pathogen attacking the plant or a reaction of anthocyanins in the plant attacking the pathogen, as seen in red leaf spot diseases. The purpose of the study is to test the interaction of Xanthomonas campestris with anthocyanin and observe whether the coloration is a defense mechanism to combat the bacteria, or a phenotypic sign of an infected plant. We hypothesize that when purified anthocyanins interact with the X. campestris, a defense mechanism will occur, inhibiting in vitro growth of the pathogen, which will translate to producing the color spots in plants. Future experiments will utilize other plant pathogens that cause these red spots, such as Pseudomonas syringae and Erwinia amylovora, to determine their interactions with anthocyanins. The overall results will elucidate the role of anthocyanins in plant diseases.

P348 - The impact of locomotion on shape of the Atlas Vertebra in Rodents

Dorothy Trent

Life University, CLINTON, SC

The study of locomotion in animals has long intrigued scientists. However, little attention has been given to the functional morphology of the vertebral column and how it relates to locomotor performance. More specifically, this study aimed to look at shape variation of the atlas vertebra within a diverse sample of rodents, in the context of locomotor performance. MicroCT and landmark based-geometric morphometrics were employed to analyze the atlas vertebrae of rodent species. The results revealed a high level of shape similarity in the dimensions of the atlas vertebrae across most rodent species. The study enhances the understanding of rodent vertebral morphology and provides insights into the interplay between spinal structure and locomotor behaviors. Most importantly, the study shows that the shape of the atlas vertebra is extremely conserved across evolutionary diverse groups. Further research is warranted to explore if the same evolutionary conservation is seen within different groups of vertebrates.

P349 - eDNA Analysis to Detect Ophidiomyces ophiodiicola in Waterways and Soil

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Sustained populations of predators, for example snakes, are of great importance to ecosystems. They assist in population control and actively help maintain biodiversity. Therefore, without them, the ecosystem could face significant damages. Due to the prevalence of the fungal disease Ophidiomyces ophiodiicola, numerous snake populations have seen a decline. This pathogen has been emerging in North America and is starting to pose a significant threat to snake health and population sustainability. Some signs of snake fungal disease include localizing thickening or crusting of the skin, abnormal molting, and facial disfiguration. This typically leads to emaciation and even death. O. ophiodiicola can be detected in soil and waterways; however, little is known about the persistence and growth of the fungus in either environment. To observe how prevalent snake fungal disease is in the North Georgia region, we are collecting and analyzing environmental DNA (eDNA). eDNA can be collected from many different environments, including the soil and water bodies, and can give a broad picture of O. ophiodiicola presence in the environment. Our detection method has been confirmed and our detection limit has been determined. Water samples have been collected from Flat Creek and have been tested for the presence of O. ophiodiicola eDNA. We are currently sampling water from Tumbling Creek as well as soil from Tumbling Creek Woods. Our results from water and soil sampling will be presented. These results will inform us of the prevalence of O. ophiodiicola in part of the north Georgia region.

P351 - Isolation and characterization of novel yeast strains from entomological and botanical samples from Weakley County: TN: USA.

Matthew Vincent, Kevin Pitz

University of Tennessee at Martin, Martin, TN

The purpose of our research was to collect, culture, isolate, and identify naturally-occurring, wild yeast strains. Our genera of interest, *Saccharomyces* and *Brettanomyces,* are commonly used commercially in the food and beverage industry, making novel strains with unique metabolic characteristics of interest. Yeast strains were isolated from insect and botanical samples collected from Weakley County in west Tennessee. To date, 84 candidate isolates were identified for molecular characterization. PCR will be used to analyze the ITS (Internal Transcribed Spacer) region (rRNA) of all viable sample. PCR products will be analyzed by gel electrophoresis and sequenced to identified samples to the levels of genus, species, strain, or to the lowest taxonomic level possible using GenBank. Herein, we present the results of the microbiological and molecular studies of these yeast samples.

P352 - Assessing the Roles of MYC in Endoderm Differentiation

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The Wnt signaling pathway, crucial in development and embryonic morphogenesis, is essential for endoderm and hindgut development in mammals and intestinal epithelium maintenance in adults, with mutations in this pathway often leading to colorectal cancers. The activation of this pathway upregulates the oncogene MYC, known for promoting cell cycle progression and proliferation, and under certain conditions, like the absence of p53, increasing EGR1 expression, leading to apoptosis. Our research focuses on the role of the MYC-EGR1 pathway in the differentiation of human induced pluripotent stem cells (hiPSCs) into definitive endoderm. Using immunofluorescence staining, we seek to assess whether MYC is absent from undifferentiated pluripotent stem cells by co-staining for the pluripotency marker OCT-4 and MYC. Next, we seek to determine whether MYC is required for endoderm differentiation by specifically targeting its expression using shRNA during endoderm differentiation. These studies will contribute to our understanding of the molecular mechanisms involved in endoderm differentiation and the role of the MYC-EGR1 pathway in the process.

P353 - The Impact of Caffeine on the Gut Microbiome (*Bifidobacterium* and *Lactobacillus*)

Nicole Rutherford, Darla Wise

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Caffeine has proven its uses for the overall health of the individual, it can specifically improve gastrointestinal health by giving the gut/colonic microbiome increased evenness and richness; along with this, too much caffeine is also something to consider. Both Bifidobacterium and Lactobacillus are extremely important microflora and helpful for the maintenance of human health. They are both Gram-positive, naturally occurring bacteria that produce lactic acid, are the main components of the gut microbiome, and are found in commercialized probiotics. To determine the effect of caffeine on the growth of Bifidobacterium and Lactobacillus bulgaricus, Bifidobacterium was grown in concentrations of caffeine including 40mg, 80mg, and 120mg in order to visualize the growth of these bacteria in the presence of caffeine compared with controls. After running samples of Bifidobacterium in MRS broth with the corresponding concentration of caffeine, it can be suggested that, at these concentrations, caffeine does not affect the growth of this bacteria (40mg P=0.08, 80mg P=0.19, and 120mg P=0.21) after 12 hours of growth. Future studies include running the same tests on Lactobacillus bulgaricus, as well as developing future analyses of caffeine on the gut microbiome.

P354 - The Impact of Noncanonical MYC Target Gene, *EGR1*, on Proliferation of Colorectal Cancer Cells with *CTNNB1* Mutation

Andrea Walker, Erick Spears

Belmont University, Nashville, TN

WNT signaling is important for regulating the APC complex. A downstream effect of the APC complex is the degradation of β-catenin, the product of the CTNNB1 gene. High levels of cytoplasmic β-catenin, and its subsequent nuclear translocation, trigger the expression of the MYC gene. In the absence of functional p53, a common aberration in late colorectal tumorigenesis, MYC triggers the expression of EGR1. EGR1 is important for tumor suppression and regulating apoptosis. To understand the role of EGR1 in colorectal tumor growth, we evaluated proliferation of HCT116 colorectal cancer cells with wild-type and mutant CTNNB1 and with or without p53. The cell lines were transfected with scramble (control) shRNA and EGR1 shRNA to evaluate the role of EGR1 in proliferation of these cells. Proliferation was studied by conducting cell counts and visually observing the cells daily. Furthermore, we assessed the decreased expression of EGR1 by quantitative real-time RT-PCR. Understanding the role of EGR1 in colorectal cancer cell growth will lend insight into the regulatory mechanisms still in place in these cells and may allow for the development of targeted treatments based on the EGR1 status of the tumor.

P355 - Measuring the Effect of Temperature on Bacterial Abundance Across Stages of Decomposition

Lukas Brown

Mary Baldwin University, Staunton, VA

Forensic science uses multiple methods to assess the circumstances surrounding the death of an individual including the presence and abundance of taphonomic species. Postmortem intervals (PMI) define the time that has passed from the death of an individual to their discovery. Observing insect and bacterial species found on corpses aids in the determination of the duration of the PMI as specific decay stages are predominated by distinct species. These ranges of predominance can be altered due to variability in the surrounding environment, such as temperature fluctuations associated with climate change. Our understanding of how temperature increases affect the abundance and temporal appearance of specific bacterial species is unknown. Fluctuations, such as the increase in temperature, are speculated to result in the increased rate of decay while decreasing bacterial species sensitive to elevated temperatures. We tested the rate of decay with respect to bacterial species in a laboratory setting. Rats were buried into 4 inches of soil and exposed to elevated temperature ranges of 6.0 °C and 3.0 °C higher than ambient temperature with ambient temperature as the control group. Bacterial samples are collected before skeletonization occurs and assessed by qPCR using the 2-ΔΔCT method to determine the differences in the abundance of bacteria between treatment groups. Visual assessment of the decomposition was recorded each day by photographs. We expect these findings to provide information on climate change effects on postmortem forensic analysis in regards to bacterial species known for decomposition.

P356 - Antibacterial effects *Liriodendron tulipifera* leaf and bark extracts

Megan Pannell, Madison Hartzog, John Lightner

Mercer University, Macon, GA

Many species of bacteria have become resistant to the antibiotics used today, so it is crucial that new antibacterial agents are discovered to overcome antibiotic resistant bacteria. Because plants were used in early medicine to heal wounds and prevent infections, this experiment focuses on
the ability of regional medicinal plants, specifically tulip poplar, *Liriodendron tulipifera*, to inhibit bacterial growth. Streptococcus mutans, *Escherichia coli*, and *Staphylococcus aureus* were treated with the tulip poplar leaves and bark extracts to determine their effects on
replication and survival of these types of bacteria. Planktonic assays were used to determine the bacteriostatic effects and use dilution assays were used to determine the bactericidal effects of the tulip poplar extracts. It was proposed that tulip poplar leaves and bark would show bactericidal effects on both gram-positive and gram-negative bacterial species. The use dilution assays showed that the tulip poplar leaves had more of a bactericidal effect on the gram-positive bacteria, *S. mutans* and *S. aureus*, than the tulip poplar bark. No bactericidal effect, however, was
shown when gram negative bacteria, *E. coli*, was treated with both tulip poplar leaves and bark. The planktonic assay displayed no bacteriostatic effects on gram-positive bacteria or gram-negative bacteria with either extract. Further testing of the extracts is needed to confirm our
results and test the effects of higher extract concentrations.

P357 - Determining the spatial distribution of vascular plants in Knox County, Tennessee using digitized herbarium specimens

Margaret Oliver, Eric Shershen, Jessica Budke

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Knox County, Tennessee occupies 508 square miles in the Ridge and Valley Province of East Tennessee. It is comprised of a variety of mixed use areas including urban, agricultural, and forested zones; it includes the confluence of the Holston and French Broad Rivers, which combine to form the Tennessee River; and is home to Knoxville, the state's third largest city and the largest in East Tennessee. Herbarium specimens have been used to document the flora of Knox County since the mid 1800s. Staff and students at the UTK

Herbarium (TENN) undertook a project to mobilize the data associated with these specimens to identify changes in the Knox County flora over time, including rare and non-native plant species. The process of transcribing the label data to a digital format for further analysis was facilitated by a Zooniverse Notes from Nature (https://www.zooniverse.org) expedition that enlisted the help of community scientists to record the data from over 1,000 specimen images from 11 institutions in the SEINet Portal Network (https://symbiota.org/seinet/). Then both the newly and previously transcribed Knox County records were georeferenced by TENN staff using GEOLocate's Collaborative Georeferencing tool (https://geo-locate.org/community/default.html) following the guidelines produced by the California Phenology Network (https://www.capturingcaliforniasflowers.org/). This resulted in over 1,500 fully transcribed and georeferenced digitized specimen records representing 784 taxa collected over more than 165 years. These data will enable researchers and the public to better understand the influence of human development on the history of Knox County's flora.

P358 - Assessing the Roles of EGR1 in Endoderm Differentiation

Sadaf Shahebrahimi, Joseph Nguyen, Erick Spears

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The Wnt signaling pathway, crucial in development and embryonic morphogenesis, is essential for endoderm and hindgut development in mammals and intestinal epithelium maintenance in adults, with mutations in this pathway often leading to colorectal cancers. The activation of the Wnt pathway upregulates the oncogene MYC and under certain cellular conditions, specifically the absence of p53, MYC stimulates EGR1 expression leading to apoptosis. EGR1 is a transcription factor known to regulate expression of genes involved in apoptosis, differentiation and general tumor suppression. Our research focuses on the role of the MYC-EGR1 pathway in the early differentiation of human induced pluripotent stem cells (hiPSCs) into definitive endoderm. Using immunofluorescence staining, we seek to assess whether EGR1 is absent from undifferentiated pluripotent stem cells by co-staining for the pluripotency marker OCT-4 and EGR1. Next, we seek to determine whether EGR1 is required for endoderm differentiation by specifically targeting its expression using shRNA during endoderm differentiation. These studies will contribute to our understanding of the molecular mechanisms involved in endoderm differentiation and the role of the EGR1 in the process.

P359 - Safeguarding the Atlanta Botanical Garden's Conservation Collections

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Conservation faces many challenges. Saving rare and endangered species is becoming increasingly more difficult as more native ranges are lost due to anthropogenic effects. Off site or Ex situ conservation is becoming increasingly necessary. Sitting at a junction between public communication and horticultural science, botanic gardens are uniquely situated as stewards of endangered plant ex situ collections. As research in ecology, biology, and genetics advances so does conservationists' understanding of best management practices. The Institute of Museum Library Services funded safeguarding project encapsulates modern conservation best practices. Through this project, we are backing up the Conservation Collections as seed, pollen, DNA samples, leaf tissue preserved on silica, and herbarium specimens housed at the University of Georgia Herbarium and the Missouri Botanical Garden. This project also works as a use case for ABG's transition to full maternal line tracking and our transition to the BRAHMS database platform. In this poster presentation, we will provide an overview of the progress towards our project goals as well as the lessons learned in terms of artificial hybridizations of pitcher plants in the genus *Sarracenia*.

P360 - Establishing a Biochemical System for the Purification and ATPase activity of GST-Dbp5

Sarah Utley, Rachel Rigsby, Rebecca Adams

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The export of mRNA out of the nucleus is a crucial step for eukaryotic gene expression. The export of mRNA transcripts is aided by Mex67, which allows export through the nuclear pore complex doorways in the nuclear envelope. Once out of the nucleus, a protein known as Dbp5, bound to ATP, Gle1, and Nup42 aids in the directionality of mRNA export by helping remove Mex67 from the mRNA strand. Following interaction with RNA, Dbp5 then hydrolyzes ATP so that it unbinds the mRNA, allowing for enzyme recycling. The goal of this study is to explore the ATPase activity of *Saccharomyces cerevisiae* Dbp5 in vitro with purified recombinant protein. Previous efforts worked towards enhancing the bacterial induction of Dbp5 with the Rosetta strain of the *E. coli*. This semester, I aimed to optimize the purification of Dpb5 from cells via affinity chromatography. To purify Dbp5, Rosetta cells were transformed with a GST-Dbp5 plasmid and induced with IPTG at 16 °C. To ensure successful induction, the bacterial cells were sonicated and the purification process was started. From the purification, trace amounts of purified Dbp5 were obtained, but not enough for ATPase assays. Future experiments will work towards further optimizing and refining the purification of Dbp5 in order to establish a biochemical system analyzing the ATPase activity of GST-Dbp5. This will help in developing ATPase assays involving Dbp5, Nup42, and Gle1.

P361 - Salvaging the LFCC herbarium: lessons learned and horizons expanded for the Extended Specimen concept.

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In 2019, the Ted R. Bradley herbarium (GMUF) of George Mason University salvaged the Lord Fairfax Community College Herbarium (LFCC), a collection of approximately 12,000 vascular plant specimens that document the flora of northwestern Virginia. This region, which includes Clarke, Fauquier, Frederick, Page, Shenandoah, and Warren counties and encompasses most of the Massanutten Mountains, has been under-collected historically. For this reason, the U.S. National Science Foundation awarded support to GMUF to incorporate, curate, and digitize the LFCC collection as infrastructure for biological research. Here we describe the lessons learned from salvaging this important collection and the research discoveries that were made by bringing these specimens to light. We highlight how we linked the digitized herbarium specimens with their field-collection and accession records using techniques from the digital humanities and new functions within Symbiota software. These methods realize some of the vision for the Extended Specimen Network of natural history collections and are an efficient, sustainable way for preserving historical field notebook data.

P362 - Analyzing Mex67 Interaction with the SSA4 Transcript for Selective Export

Gretchen Stalnaker, Rebecca Adams

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In eukaryotic cells, such as the budding yeast *Saccharomyces cerevisiae,* mRNA export is the essential process in which mature mRNA is transported from its site of production, the nucleus, through the nuclear pore complex (NPC) to the cytoplasm, where it can then be translated into protein. This is accomplished when a transcript interacts with the mRNA export protein Mex67, which shuttles the message across the NPC. When the cell is under conditions of stress, such as heat shock, most mRNA export is prohibited to allow for selective gene expression for cell recovery. However, some transcripts are able to be selectively exported and expressed in these conditions. An example is *SSA4*, which encodes a protein that assists denatured proteins to refold under stress conditions and is up-regulated in response to heat shock. It is not known how *SSA4* is selectively exported from the nucleus. I hypothesize that an unknown adaptor protein binds to the *SSA4* transcript to recruit Mex67. To test this hypothesis, we will perform a yeast three-hybrid (Y3H) test by constructing a plasmid which contains the *SSA4* ORF and 3' UTR, in addition to MS2 hairpins. This construct will be assessed for interaction with Mex67. If no interaction is observed, then we will perform a screen for other proteins that are able to interact with the *SSA4* transcript.

P363 - Measured and Modeled Light Interception in Winter for Yucca Plants with Implications for their Ecophysiological Functioning

Alan Huff, Howard Neufeld

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Interception of light by plant leaves depends on leaf orientation and solar position, which varies with the sun's path through the sky as determined by season and latitude. Yuccas have a regular and pronounced radial leaf arrangement with younger leaves more vertically oriented than older ones. This results in unique radiation interception patterns for each leaf, such as direct sunlight hitting the abaxial (lower) leaf surfaces, and self-shading by neighboring leaves. This creates varying radiation intensity across each leaf on a plant, with potentially significant impacts on gas exchange and photoinhibition. We created a program in Python that generates a 3-D model of a Yucca plant based on its leaf architecture and uses raytracing to predict direct sunlight intensities for variously oriented leaves. Measurements of leaf base height and radius relative to the stem axis, horizontal and vertical distances between the measured leaf base position and the tip, leaf aspect, and inclination at both base and tip were made for leaves of a Yucca cultivar on the Appalachian State University campus. Direct light intensities were simulated for a day in January close to when these measurements were made. Abaxial surfaces of north-facing leaves had an average estimated PAR of 730 μmol • m-2 • s-1 based on preliminary measurements, which is higher than for any other group of leaves. This means that in winter, more light enters lower surfaces of these leaves than enters their adaxial (upper) surfaces and those of leaves facing other directions. Since light penetration and scattering differ depending on if PAR enters abaxially or adaxially, there could be consequences for photosynthesis and photoinhibition that vary between leaves. We plan additional measurements to determine variability in radiation interception among leaves and its effect on the integrated carbon and water economy of these plants.

P364 - Testing SSA4::ADE3 Reporters and MCS Screening

Chloe Ledford, Rebecca Adams

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Gene expression is essential to life and occurs through the processes of transcription of mRNA in the nucleus, export of transcripts to the cytoplasm through the nuclear pore complex (NPC), and translation of the mRNA into protein in the cytosol. The budding yeast *S. cerevisiae* is a eukaryotic model system used to explore the regulation of mRNA export. Transcripts are able to exit the nucleus through interaction with Mex67 which binds mRNA via adaptor proteins and allows crossing through NPCs. However, during heat shock (42°C) known adaptor proteins are rendered dysfunctional thus halting general mRNA export. Under these conditions, specific transcripts are able to exit the nucleus to enable the cell to response to stress. For example, *SSA4* encodes a chaperone, which helps denatured proteins refold following heat shock is able to selectively export in response to stress. However, the mechanism for this selective export is not

understood. I hypothesize that an unknown adaptor protein recruits Mex67 to allow for its selective export from the nucleus. In order to test this hypothesis, I have cloned a pair of vectors to be used as phenotypic reporters for SSA4 export. These reporters include the ADE3 ORF and *SSA4* regulatory sequence (promoter, 5' and 3' UTRs). We anticipated that these reporters would yield red yeast cells if selectively exported during heat shock conditions. Analysis of the first reporter plasmids indicated that the plasmids weren't fully cloned as expected, and subsequent experiments aimed at generating the proper clones did not produce clear results to continue the project. In the future, this project will be reimagined using CRISPR technology which aims to integrate the LacZ gene into the SSA4 locus. The new method has the potential to similarly serve as a colorimetric assay while eliminating previous issues of leaky expression and false positive results.

P365 - Tissue Culture Applied to the Eastern Hemlock Tree (*Tsuga canadensis*)

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Throughout the East Coast of the United States, the Eastern Hemlock Tree (*Tsuga canadensis*) of the Pine Family can be found in large populations ranging as far north as Canada and Nova Scotia to the Southern states of Alabama and Georgia. Throughout this range, the invasive insect, the hemlock woolly adelgid (HWA), can also be found living on many of these trees. After its accidental introduction to the Eastern United States in the early 1950s, HWA spread throughout the East Coast in every direction for the next seventy years. As HWA populations thrive and Hemlocks die back to a near threatened status, many institutions and researchers have been conducting research into ways to both preserve the Eastern Hemlock species and fight against the woolly adelgid. Of these attempts, the micropropagation and plant tissue culture of Eastern Hemlocks through this experiment serves as a prospective solution to restore the native Hemlock population and assist it in bouncing back from the onslaught of HWA. Successfully tissue culturing would provide many genetically identical copies of a Hemlock sample, and if an HWA-resistant Hemlock is found or created, it can be tissue cultured and spread. Though research and trials continue in this field, contamination and the reactivity and sensitivity of culture samples throughout the 5-stage micropropagation yield mixed results. Various methods, including using different parts of Hemlock samples and utilizing different methods of micropropagation and tissue culture, continue to be tested through this experiment.

P366 - The Effects of Curcumin and Carvacrol on *Pseudomonas aeruginosa* PA01 Biofilm Formation

True Lookenott, Simone Chock, Diby Paul, Rick Austin

Truett McConnell University, Cleveland, GA

The formation of biofilms presents economic and medical implications, including the increased presence of antibiotic resistance strains of bacteria. Combating this rise in antibiotic resistance among infectious bacteria has precipitated numerous studies attempting to determine mechanisms that reduce both biofilm production and, concomitantly, antibiotic resistance. The use of naturally occurring compounds to reduce biofilm formation has received attention in the research literature. Curcumin is secondary metabolite derived from turmeric (Curcuma longa), and carvacrol can be found in several medicinal plants including oregano. Both compounds have been shown in previous studies to reduce biofilm formation significantly in various bacteria via quorum quenching (QQ). Pseudomonas aeruginosa (PA) is an opportunistic, Gram-negative pathogen that is known to be the source of severe hospital-acquired infections (HAIs), to be the leading cause of death for cystic fibrosis patients, and to be rising in antibiotic resistance. Thus, it has become a model for biofilm formation and its quorum-sensing mechanisms are well known. To further the investigation into the ability of curcumin and carvacrol to reduce biofilm production, a well diffusion assay was used to determine the minimum inhibitory concentration (MIC) of both compounds against PA-01. The MIC for curcumin and carvacrol against PA-01 was determined to be 250µg and 200µg, respectively. The effects of both compounds on PA-01 biofilm formation were determined using the crystal violet biofilm estimation assay. One-way analysis of variance (ANOVA) tests and Tukey's post hoc tests indicated that carvacrol concentrations of 130µg/mL and 160µg/mL significantly reduced biofilm formation (= 12.4, $p < .001$) when compared to the controls. However, carvacrol concentrations of 200µg/mL, as well as all concentrations of curcumin, did not show significant reduction in biofilm formation. Analysis of findings and the need for clarifying future research regarding natural-occurring compounds and the potential for biofilm reduction are discussed.

P367 - Discovering Diversity: A Morphological Investigation of the *Packera aurea* Species Complex

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The genus Packera in the Asteraceae family is historically known for having unclear species boundaries, creating species complexes with varying morphology. One example is Packera aurea L., which was historically subdivided into several distinct varieties, but were all combined when Packera was split from the Senecio super-genus. Packera aurea is distributed across the Northeastern and Midwestern U.S., extending North into southern Canada and south into northern Georgia, with one disjunct occurrence in the Apalachicola region of Florida. The aim of this study was to evaluate whether there is cryptic diversity within P. aurea via morphometric analysis. Using herbarium vouchers and field collected of North Carolina material, Packera aurea sensu stricto was compared to two cryptic taxonomic entities: a pervious recognized variety, Senecio aureus var. gracilis (Pursh) Hook, and to an unnamed entity occurring in the southern Appalachian Mountains that the authors feel may warrant taxonomic recognition. 44 vegetative and floral characters were measured for 101 specimens and the resulting variability was visualized using principal component analysis, principal coordinate analysis, non-metric multidimensional scaling, and canonical discriminant analysis. Initial results indicate the presence of cryptic diversity within P. aurea populations in North Carolina with S. aureus var. gracilis and the unnamed entity forming distinct clusters but still overlapping with P. aurea sensu strictu. Further taxonomic and genetic sampling should be utilized to recognize cryptic diversity and for taxonomic revisions of the species.

P368 - Mouthful of Mysteries: Characterizing the Oral Microbiome through Oxford Nanopore Next Generation Sequencing.

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Catawba College, Salisbury, NC

The oral microbiome is the gateway to you. Many bacteria first enter your body through the mouth. Although there are some transient residents in the oral cavity who are just waiting to enter the digestive microbiome, there are many regular residents who are not looking to travel to the bowels. The goal of this research is to characterize the oral microbiome. Several participants are providing samples from three different days. For consistency the samples are collected first thing in the morning before brushing and breakfast. The samples are collected with three different devices, two different buccal swabs and saliva collection. DNA will be isolated from the samples and the complete 16S rDNA will be PCR amplified. These metagenomic amplicons will be transformed into Oxford Nanopore libraries for next generation sequencing (NGS). The results will be analyzed with EPI2ME software.

P369 - Morphological Differences in the Schweinitz's Sunflower (*Helianthus schweinitzii*) in North and South Carolina

Casey Green, Leighton Shehan

Winthrop University, Rock Hill, SC

Schweinitz's Sunflower (*Helianthus schweinitzii*) is a federally endangered sunflower species. The species is native to the North and South Carolina Piedmont regions and is commonly seen in disturbed areas, prairies, and under power lines. While collecting plant samples for the molecular study, we found great variations among the populations. These variations included the leaf shape, size, and base shape. We used voucher specimens and new collection from various populations in both North and South Carolina. After gathering data for the vegetative and reproductive parts, we found leaves from North Carolina populations formed a lance shape, while the populations from South Carolina had a round base and were much broader. Additionally, length and width of involucral bracts were seen to be larger in South Carolina populations, whereas the number of ray florets did not differ in either. The differences found in these two forms could lead to the division of the species to two varieties or subspecies.

P370 - The Role of the Second Messenger Ap4A in the Fitness of *Staphylococcus aureus* During Respiratory Stress

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Staphylococcus aureus is a pathogen with a high prevalence of antibiotic resistance and is responsible for a majority of skin and soft tissue infections (SSTIs) in humans. Here, we aimed to determine the role of Ap_4A as a second messenger pathway involved in the *S. aureus* respiratory stress response during infection. Ap_4A is synthesized from AMP and ATP when aminoacyl tRNA synthetases lack tRNA substrate. Ap_4A is subsequently degraded into two ADP by the enzyme YqeK in *S. aureus*. Ap_4A exists in both prokaryotes and eukaryotes, but it is unclear whether it is primarily a damage signal in bacteria when exposed to stress or whether it also plays an important signaling role. As the mechanisms of Ap_4A are yet to be fully understood, more research is needed to clarify its effects in *S. aureus* and its potential as a drug target. Here, we characterize the impact of *yqeK* deletion and overexpression on *S. aureus* during anaerobic and nitric oxide ($NO\cdot$) induced respiratory stress. While deletion of *yqeK* had a significant impact on *S. aureus* fitness during stress, overexpression of *yqeK* did not impact fitness. Subsequent phenotypic and transcriptional analysis will provide new insights into the role Ap_4A plays as a potential secondary messenger important for responding to respiratory stress in *S. aureus*.

P372 - Detection of Last-Resort Antibiotic-Resistant Bacteria in Sewage Influent

Richard Watkins, Hannah Rollins, Grace Strano

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The presence of antibiotic-resistant bacteria, especially against current last-resort antibiotics, is a growing crisis in the medical community. Identifying bacteria that demonstrates resistances toward last-resort antibiotics is crucial for monitoring and understanding the spread of resistant strains in the environment. This knowledge is essential for developing effective strategies to mitigate the impact of antibiotic resistance to public health. To this end, using sewage influent as a sentinel environment, we utilized a culture dependent methodology to detect Gram-negative bacteria showing resistances toward Imipenem, Tigecycline and Colistin (Polymyxin E). Isolates showing residences towards one or more of these antibiotics was further characterized using 16S rRNA sequencing, biochemical test and for the presence of known antibiotic resistance genes.

P374 - Performance comparison analysis of the CareSuperb COVID-19 antigen home test with three other antigen tests using patient-derived specimens

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The SARS-CoV-2, first discovered in 2019, has caused numerous infections worldwide and led to significant social and economic losses. Due to its unprecedented transmission capabilities, the virus quickly spread, leading to shortages of equipment and skilled personnel needed for diagnosis. This made early diagnosis and isolation of infected patients difficult, resulting in an increasing number of infections, overwhelming public health systems, and escalating casualties. To support existing diagnostic capabilities, rapid antigen tests that can be used by the general public without expensive equipment or skilled personnel are being rapidly approved and distributed to households. Through rapid antigen testing, lay users can easily conduct self-diagnosis at home, reducing the spread of the disease and minimizing losses due to illness. However, while conventional rapid antigen tests are easy to use and provide quick diagnoses, they often have low sensitivity and require molecular diagnostic tests with equipment and skilled personnel to verify results. Therefore, if antigen tests with sensitivity far exceeding that of existing rapid antigen tests were available on the market, it could significantly reduce losses due to diseases such as COVID-19 in future outbreaks. To overcome the limitations of existing antigen test platforms, Access Bio, Inc., located in New Jersey, has developed the CareSuperbTM COVID-19 antigen home test (CareSuperb) using new platform technology. To validate the new platform technology, comparative tests were conducted between existing COVID-19 antigen tests available on the market and CareSuperb using clinical remnant samples (CRSs). Interestingly, CareSuperb exhibited significantly superior sensitivity compared to existing products, particularly showing a higher sensitivity difference in CRSs with low virus titers, which are difficult to diagnose with conventional antigen tests. Our results indicate that CareSuperb outperforms other COVID-19 antigen home tests, making it an effective solution for reducing societal losses due to COVID-19 infection.

P376 - Bacterial contamination of environmental surfaces in the intensive care unit of a veterinary clinic

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In recent years a great deal of research has suggested that environmental surfaces in healthcare facilities are often contaminated by pathogenic bacterial species. Whether this type of contamination contributes to healthcare associated infections (HAIs) has not been resolved. This issue is even worse if you consider healthcare facilities for animals treated by veterinarians. The purpose of this study was to investigate bacterial contamination of environmental surfaces in an intensive care unit of a veterinary hospital. After obtaining permission to conduct our study we identified 31 locations within the hospital's intensive care unit. Swab samples were collected from these 31 sites on two dates in 2023. After collection the swabs were transported to a microbiology lab on the UTC campus. In the lab these swabs were used to inoculate selective and differential media (Mannitol Salt Agar [for Staphylococci], CHROM MRSA agar [for methicillin resistant S. aureus – MRSA], Mannitol Salt Agar with Oxacillin [for S. pseudintermedius], Cetrimide Selective Agar [for Pseudomonas sp.], Hektoen enteric agar [for Salmonella sp, and Shigella sp.]. Overall, we observed viable bacteria on 35 of 62 swabs (56% positive) for the two dates. The species found in the highest concentrations were Staphylococci (50% positive). MRSA was found on 18/62 swabs (29%), while the noted dog pathogen S. pseudintermedius was only found on 2/62 sites (3%). Gram negative bacteria (enterics, Pseudomonas, and Salmonella or Shigella) were also found throughout the unit (totaling 25/62 swabs or 40%). This data does not imply any direct links to HAIs in the veterinary patients, however it does suggest that clinics for animals are comparable with clinics for humans that our research group has sampled in the past with regard to bacterial contamination. Evaluations of surface cleaning and disinfecting procedures for the veterinary clinic may be in order.

P378 - *Bordetella pertussis* Cloning and Conjugation

Alec McMahon, Elizabeth Schoenfeld

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The pathogenic microbe, *Bordetella pertussis*, is most recognizable for causing the disease commonly known as whooping cough. A whole-cell vaccine for *B. pertussis* was first developed in 1914 and it later became one part of the DTP combined vaccine in 1948. Since the development of these vaccines, *B. pertussis* has lost its prominence in research labs and remained understudied as a result. This research was performed to continue identifying gene 00815, one of many ambiguous genes in *B. pertussis*. Genetic comparisons with other related bacterial genes have identified this gene to be involved in the production of lipopolysaccharide (LPS) membrane components. To test this relationship, cloning was used to develop a mutant for observation and characterization. Gibson assembly and traditional cloning were both used to insert DNA fragments into a cloning plasmid designed to integrate into the B. *pertussis* chromosome to create the mutant. .The edited plasmid will be inserted into *E. coli* that can undergo conjugation with *B. pertussis* to transfer the plasmid. Early results indicate that the Gibson assembly method is unsuccessful at creating a mutant. Experiments are underway to determine the success of traditional cloning in creating the 00815 mutant.

P380 - Comparison of the Different Types of Microorganisms Found in Commercial Yogurt

Sydnee Floyd, Elizabeth Schoenfeld

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Yogurt is a common probiotic consumed regularly for its health benefits. Probiotics are microorganisms that are found in many everyday food items and promoted as "healthy bacteria." Probiotics are reported to have many health benefits with the most prominent being a healthy digestive system since microorganisms are known to help digest foods. This research had two major goals 1) determine if the serving size of commercial yogurt brands contain the recommended number of probiotics for improved health and 2) does the number of probiotics per serving size change overtime in multi-serving yogurt tubs. Over a four week period multi-serving yogurt tubs of five different brands were tested to determine CFU/gram and the identity and quantity of the major genera of probiotic using microscopy

and staining. The results of this study demonstrate that single serving and multi-serving tubes of yogurt both contain the recommended number of probiotics per serving needed to maintain gut health. Additionally, we observed that the total number of probiotics does not change over time per serving in the multi-serving tubs over the four weeks; however, the relative ratio of each genera of probiotic in the multi-serving tubs did change over the course of the four weeks. These results suggest that the health benefits attributed to one specific genera of probiotic bacteria could change over the course of consuming a multi-serving tub of yogurt.

P382 - Identification of candidate biomarkers from lead-exposed biofilms, quantification of biofilm biomass and lead-associated genes.

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Interactions between biofilms and potable water inside building plumbing systems are a concern for drinking water quality. Further, the impact of heavy metal exposure on these biofilms have not been investigated and has major implications for human health. To interrogate this, a pipe loop was constructed to investigate the dose-dependent effects of lead (0 µg/L, 5 µg/L, and 500 µg/L) on bacterial biofilm communities during and after a lead exposure event on high-density polyethylene (HDPE) and cross-linked polyethylene (PEX-A) pipes. The results indicate that all tested factors (pipe type, time, exposure levels) influence the structure of biofilm communities. Furthermore, community structure and biomarker taxa persist in their modified form even after the removal of lead using multiple lines of evidence. Further, biomarker organisms were identified for high lead exposure. These organisms include *Sphingopysix* sp., *Rhizobium* sp., *Noviherbaspirillum* sp., and *Sphingomonas* sp. Surprisingly, removal of lead did not alter the relative abundances of these organisms. The findings reveal that biofilm communities and specific species that are sensitive to lead continue to exist in the "high-lead state" even after the removal of lead from the system. Further, we quantified biofilm biomass and the occurrence of the lead-cycling genes *smtAB* and *bmt* using ddPCR (droplet digital PCR). The probability of occurrence of the *smtAB* gene in PEX-A pipe was seen to be associated with lead concentration. The biofilm communities inhabiting PEX-A pipes exhibit minimal changes over time when exposed to varying levels of lead, while the communities associated with HDPE pipes display strong shifts in community structure. This work provides crucial insights into the impacts of lead on biofilm communities within household plumbing systems and established a precedence for the development of a monitoring tool for identifying a previous but not ongoing lead exposure event.

P384 - Evaluating Gastrointestinal Tract (GIT) Microbiomes Sensitivity and Muscle Metabolism in the Presence of Various Concentrations of Oxalic Acid

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Oxalic acid (OA) is a toxic, organic compound found in eaten foods and vegetables. It can prevent the absorption of essential minerals causing damage to humans that may not result in immediate effects. Studies have shown that OA disrupts the gastrointestinal tract (GIT) microbiome in humans and causes disorders such as kidney stones, arthritis, and irritable bowel syndrome. We examined the effects of different concentrations of OA on six species of bacteria (Proteus mirabalis, Klebsiella pneumoniae, Pseudomonas aeruginosa, Shigella flexneri, E. coli, and Salmonella) using the Kirby Bauer test. In addition, the effects of OA on skeletal muscle contractions were also observed under a dissecting and compound light microscope. Based on zones of inhibition on agar plates, our results indicated that some GIT microbiome may be susceptible or bacteriostatic in high concentrations of OA. Preliminary results also suggest that it may affect muscle concentration if available in the body above optimal quantity. These results may provide some merit; therefore, more time and resources are needed to further study the effects of OA on GIT microbiome and muscle metabolism.

P386 - Using CRISPR Interference for the Knockdown of Essential Genes in *Staphylococcus aureus*

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CRISPR interference is a technique that utilizes a catalytically "dead" Cas9 complex to sterically block transcription of a specific gene targeted by a single guide RNA. This can be used for knockdown and subsequent study of essential genes in bacteria, especially those lacking corresponding mutants in transposon mutant libraries. This project worked to optimize a CRISPR interference system designed for the knockdown of essential genes in Staphylococcus aureus used by undergraduate students in an upper-level Molecular Biology lab course. Our labs previous attempts to optimize a CRISPR interference system were hindered by supercoiling and extremely inefficient restriction enzyme digestion of the large plasmid (pRMC2-CRISPRi) which had been designed as a vector. This resulted in a low success rates for students creating novel plasmids in the Molecular Biology lab course (2/15 students, or 13%). Here, we utilized a newly reorganized plasmid vector with reduced size and a different backbone (pCN52-CRISPRi). Gel electrophoresis showed that digestion of the new vector with BsaI had greatly increased efficiency, with no undigested vector remaining visible. Guide RNAs were ligated into the new vector via Golden Gate assembly, confirmed via colony PCR and sequencing, and then the completed plasmids were transformed into S. aureus RN4220. Efficient knockdown of the desired genes was verified via qRT-PCR. The increased efficiency of the new system resulted in 12/15 (80%) undergraduate students in the lab course successfully creating novel knockdown plasmids. Future work aims to transform the plasmids into a clinically-relevant S. aureus strain for further study of essential gene function.

P388 - Investigating Alternatives: Microbial Solutions for Pest Management in Organic Farming Practices

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This research delves into the dynamic challenges encountered in the realm of organic pest management with a specific focus on addressing the diminishing efficacy of bacillus thuringiensis (Bt) sprays in combating herbivorous insects. The inquiry shifts it's emphasis towards an explanation of the potential Alternatives presented by naturally occurring epiphytic bacteria sourced from organic farms These epiphytic bacteria will undergo meticulous isolation and chemical analysis to discern proteins comparable to those found in Bt. the study adopts a comprehensive methodology that integrates both observational and experimental data to evaluate the effectiveness of these alternative solutions in mitigating plant-herbivore interactions the anticipated outcomes of this investigation are poised to contribute significantly to the existing body of knowledge surrounding the utilization of epiphytic bacteria as insect repellents furthermore the findings are expected to furnish valuable insights into the intricate dynamics governing plant-herbivore relationships. This research therefore underscores a retrospective analysis of work undertaken shedding light on an accomplished endeavors in their implications for advancing our comprehension of sustainable pest management practices.

P390 - Genetic and Physical Characterization of an Unknown Bacteriophage from a Commercially-Available Sample of *Bacillus thuringiensis*

Dinene Crater, Caroline Paccione

High Point University, High Point, NC

Bacillus thuringiensis (Bt) is a common soil bacterium that is used as a natural insecticide since its spores are toxic to insects when ingested. Previous research in our lab isolated an unknown phage from a commercially available sample of Bt. Bacteriophages, also known as phages, are viruses that specifically infect bacteria and are harmless to animal and plant cells. The purpose of our research is to perform structural and genetic characterization of this unknown Bt phage. DNA was isolated from the phage and subjected for RAPD-PCR analysis to produce a PCR fragment. Preliminary DNA sequence analysis of the 644 bp PCR fragment showed a 99.2% identity to other Bt and *Bacillus cereus* lysogenic phage over only 17% of the DNA. From this data, we hypothesize that we have isolated an uncharacterized Bt phage. To differentiate this Bt phage from known samples, we will subject purified Bt phage genomic DNA to whole-genome sequencing. This should yield a more complete genome sequence than a small PCR product for a BLAST sequence analysis. We will also attempt transmission electron microscopy from a high titer of purified Bt phage. This will allow for a structural comparison with other known *Bacillus* phage. Combining genetic and structural analyses will help to determine if we have isolated a previously uncharacterized Bt phage.

P392 - Analysis of *Escherichia coli* presence in Rocky River and Cox Creek of Anderson, SC

Howard Casey Blair, Sydney Davis, Carrie Koenigstein

Anderson University, Anderson, SC

Escherichia coli (E. Coli) is a fecal coliform bacteria found in the digestive systems of livestock and humans. Pathological strains of E. Coli are known to cause foodborne illness globally. Previous research on local Anderson, South Carolina streams identified the presence of E. coli with the H7 flagella indicative of the E. Coli O157:H7 strain which is of particular concern. This research was Western Blot based using an antibody against the H7 flagella protein. Our project utilized the SC Adopt-A-Stream protocols to sample the Rocky River and Cox Creek in Anderson using 3M Petrifilm E. coli/Coliform Count Plates to quantify overall E. coli levels. Individual colonies that identified as E. coli through the Petrifilm plates were selected for further characterization. Genomic DNA was purified from the colonies and sent for 16s rRNA Gene Sequencing (V1 to V9 regions) for bacterial identification. Several of the putative E. coli colonies were subsequently identified as other bacterial species by these sequencing-based methods including Raoultella planticola and multiple Shigella species. This genetic sequence data allows for phylogenetic characterization of the bacterial species isolated, and a more detailed understanding of the microbial environment of these bodies of water.

P394 - Phylogenetic analyses of *Perezia* using chloroplast genetic markers to identify a potential new species

Bria Gooden, Edgardo Cruz, Paige Ellestad, Jennifer Mandel

University of Memphis, Department of Biological Sciences, Memphis, TN

Based on distinctive morphology, a new species of *Perezia* has been hypothesized to be discovered in South America. Previous work has been conducted to assess phylogenetic relationships within this genus and sister genera using sanger sequencing. This study aims to build off previous research by using a region around trnL, a gene vital in protein synthesis, to create a phylogenetic tree and determine if *Perezia sp.* is a new species. By using the conserved trnL gene in chloroplasts, sequences can be compared to better understand phylogenetic relationships within the genus. In our lab at the University of Memphis, we will be amplifying specific sections of DNA and conducting sanger sequencing. We will use Bayesian and maximum likelihood methods to create phylogenetic trees. Results from this study will increase our understanding of *Perezia* phylogenetics.

P396 - Transgenerational maternal effects on cold adaptation in the *Drosophila melanogaster*

Elmira Umarova, Bloo Mitchell, Philip Kohlmeier

University of Memphis, MEMPHIS, TN

Global climate change and increased temperature stability impacts physiology and behavior of almost all organisms. Ectothermic animals, such as insects, in which all life processes directly depend on temperature are particularly affected by changes in temperatures. Transgenerational effects, in which parents induce phenotypic adaptations in offspring, have been suggested by theoretical studies to buffer such temperature fluctuations. However, empirical data demonstrating the existence and unravelling the underlying mechanisms are scarce. We used the fruit fly *Drosophila melanogaster* and the neurogenetic toolkit exclusively available in this species to assess whether maternally induced temperature adaptation exists and whether the induction of these maternal effects is under the control the mother's thermosensory neurons. We first demonstrated that larvae of mothers grown at warm temperatures (+29°C) recovered faster from a cold shock than larvae of mothers raised at cold temperatures (+18°C). To test whether temperature perception by the mother's nervous system is involved in modulation maternally induced cold adaptation, we generated flies in which heat- or cold-perception pathways were genetically silenced. We found that silencing of cold-sensing neurons in mothers had no effect on larval cold adaptation whereas silencing heat-sensing neurons induced cold adaption even if their mothers were kept at warm temperatures. These findings suggest that the regulation of larval cold adaption is not a passive biochemical process but under active control of the mother's nervous system and that cold adaptation in offspring is suppressed if the mother's nervous system senses hot temperatures.

P398 - Tree Biodiversity in Urban and Nonurban Forests

Rowan Christopher, Morgan Daise

Agnes Scott College, Decatur, GA

As cities continue to expand, established natural forests will grow more urban, and it is important to study the implications of that on the existing ecosystem. Furthermore, in order to protect new and established urban forests, we must first know how they function. In this project, we examined the differences between growing strategies of trees in urban forests and nonurban forests. Growing strategies for tree species in urban forests and their nearest National Ecological Observatory Network (NEON) sites were characterized by assigning each species a competitive: stress-tolerant: ruderal (CSR) score. Ternary plots were generated and visually compared between urban forests and their nearest NEON site. When the ternary plots' mean and median values were visually compared, we came to three conclusions: species that grow in urban forests are more ruderal; between urban forests, species growing in forests with higher levels of disturbance tended to be more ruderal; and between nonurban forests at increasing latitudes, the standard deviation of CSR scores increased. Overall, we conclude that the growing methods employed by trees in urban forests differ from those in non urban forests due to differences in latitude and disturbance levels. It is our hope that this information can contribute to the understanding of urban forests and this procedure be used in further studies in urban forests and areas of historical disturbance.

P400 - Heavy Metal Impacts on Alligator Weed

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Investigations were conducted to study the tolerance of Alligator Weed, *Alternanthera philoxeroides*, to increasing concentrations (1, 5, 10 ppm) of heavy metals including lead, copper, chromium, and cadmium. Alligator Weed is a nonnative invasive plant that originated in Brazil and Argentina and can be found infesting freshwater ecosystems throughout the southeastern United States. Despite its status as an invasive plant, Alligator Weed has been reported to be a remarkable heavy metal hyperaccumulator. This study focuses on the phytoremediation potential of Alligator Weed to remove heavy metals from the aquatic environment and determine metal translocation within plants comparing metal concentrations in leaves and stems. To determine plant stress due to metal absorption, a field fluorometer, which measures Photosystem II efficiency, was used. Plants exhibited no increased stress due to heavy metal absorption making this plant an ideal candidate for such things as treatment of wastewater effluent, industrial pollution, or mining contamination of aquatic systems.

Keywords: *Alternanthera philoxeroides*, heavy metals, phytoremediation, invasive plants.

P402 - The Ecology and Genetic Diversity of *Buckleya distichophylla* (Santalaceae)

Montana Hill, Conley K. McMullen

James Madison University, Harrisonburg, VA

Piratebush (*Buckleya distichophylla*) is a native, rare, shrub found along the Blue Ridge mountains in North Carolina, Virginia, and Tennessee. Research on its ecology and genetic diversity is limited due to its rarity; with only one population, located on Poor Mountain in Roanoke County, Virginia, having been studied extensively in the past. To determine whether there are ecological differences between the Poor Mountain population of B. distichophylla, and a population located on Dragon's Tooth Trail, also in Roanoke County, research on sex ratio, recruitment, and light vs height were conducted for comparison. Research on genetic diversity between the Virginia populations and additional representative populations from North Carolina and Tennessee are being conducted to determine if differences in the chloroplast DNA exist possibly due to reproductive isolation. Preliminary results show that both populations in Virginia are male dominated, with the population on Poor Mountain being less male dominated compared to the population on Dragon's Tooth. A complete understanding of the pollination biology of B. distichophylla remains elusive, however both populations in Virginia exhibit recruitment, albeit relatively low. Data involving differences in light availability to piratebush individuals is presently being analyzed. No genetic differences between populations have been demonstrated as of yet using chloroplast DNA.

P404 - Slope Dynamics on Bryophyte Biodiversity

Julia Kolb

Undergraduate Researcher, Richmond, VA

Mosses have a tendency to be more resistant to harsh environmental conditions that vascular plants cannot typically withstand. This is especially true when looking at topographical features. In Thomas Lee's comparative analysis of bryophytes and understory plant beta diversity in relation to elevation gradient, it was found that as elevation increases, vascular plant diversity has a tendency to decrease while bryophyte diversity stays the same (Lee et al, 79).

An observational study was conducted summer of 2023 at VCU's Rice Rivers Center in Charles City, Virginia, to measure bryophyte diversity in relation to substrate, topography, and proximity to a body of water. Ten transects were laid out perpendicular to a creek. Samples were collected, and information was recorded regarding the substrate, canopy cover, elevation, and sporophyte presence.

Contingency analysis showed a clear correlation between sporophyte presence and substrate, with a much smaller sporophyte presence found on epiphytic bryophytes. There was no significant correlation between elevation and frequency, nor between canopy cover and frequency.

P408 - A tale of two "species": Investigating evolutionary relationships of two arctic/alpine Packera (Asteraceae) taxa using phylogenomics.

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Compositae, also recognized as the sunflower family, is the largest flowering plant family, encompassing approximately 10% of the world's flowering plant diversity. Within this family lies the complex genus Packera. Hybridization within the genus has made defining species boundaries within Packera complex, notably apparent in the blurred differentiation between two currently named species: Packera heterophylla and Packera cymbalaria. While P. cymbalaria holds a more established status with extensive publications in the US and Canada, P. *heterophylla* remains relatively underexplored. Geographically, P. cymbalaria spans across the northwest of North America (including Canada, and Alaska), while P. heterophylla is mainly found in Russia with some distributions within Canada and Alaska. Not only is there geographical overlap, but both species share similar morphological traits, further complicating their differentiation. This has led botanists to believe that P. cymbalaria may have been misidentified as P. heterophylla upon its discovery in Russia, potentially suggesting that they are a single species. In this study, a nuclear phylogeny was generated using Hyb-Seq methods to determine the evolutionary relationships between these two species and see if there is genetic separation. Leaf tissue was collected from herbarium samples and spanned the ranges of both P. heterophylla and P. cymbalaria. We hope that findings from our study will help contribute to a better understanding of the ongoing ambiguity surrounding these two taxa.

P410 - Genetic and phenotypic diversity within and among isolated populations of the *Erigeron strigosus* (Asteraceae) species complex in North Carolina and Arkansas

Anastasia Wilson, Katherine Mathews

Western Carolina University, Cullowhee, NC

The *Erigeron strigosus* Muhl. Ex Willd (Asteraceae) species complex is composed of late spring to early summer herbs that are widespread in North America. Many populations of this complex are polyploid and apomictic, but studies have identified sexual, diploid populations specializing on glade habitats throughout the southeastern United States, several of which have been described as new species. Two unusual Erigeron populations were recently discovered in Jackson Co., western NC: one on an olivine outcrop that displays distinct morphological variation from other E. strigosus, including earlier flowering time, shorter stems, and disconnecting, over-wintering rosettes, and a second on a high-elevation, mafic rock outcrop in which individuals are taller, have more stems, and are rhizomatous. Plants from both populations were confirmed to be diploid and phylogenetically distinct from each other based on nrDNA ITS and ETS regions. However, additional genetic and environmental information is needed to determine whether these populations constitute different species from each other and from diploid populations elsewhere. Amplified Fragment Length Polymorphisms (AFLP) provide an efficient system for genetic fingerprinting, and AFLP fingerprints for each plant sample have been generated for analysis to compare to diploid populations in AR and confirm the sequence data results. Additionally, I collected soil pH and nutrient data and measured reproductive and vegetative morphological traits on plants across transects from Erigeron populations in NC and will do so for AR populations to further analyze the variation found among populations in this complex. To study environmental plasticity, I am germinating seeds from NC and AR populations for use in a common garden experiment. Combined, these methods will enable me to analyze genetic, environmental, and morphological differences across populations and geographic localities to ultimately determine the species status of the newly discovered populations in western NC.

ASB Lightning Talks

8385 - The Cure for Cancer Could Be Inside You

Matthew (Matt) Kroeger

NMDP (formerly Be The Match; effective 1/1/2024), Minneapolis, MN

NMDP is a global leader in cell therapy that is mobilizing everyday people to save lives. With our partners, we drive groundbreaking research, treatment and support to cure blood cancers, disorders and beyond. Many attendees may not be aware that 70% of patients do not have a fully matched donor in their family, and the cure for a stranger's blood cancer or disease could be located inside them—in their healthy peripheral blood stem cells (PBSC) or bone marrow. For more than 35 years NMDP has operated the most diverse and effective registry in the world, comprised of more than 9 million individuals who have committed to answering the call if they are a genetic match for a patient in need of a life-saving treatment. Through advances in science and health care, 90% of the donations for patients today are now non-surgical. Sadly, a large disparity gap still exists and the odds of finding a match for a black or African American patient is only 29%, 47% for Asian or Pacific Islanders; 48% for Hispanic or Latino; 60% for Native American; compared to 79% for white/Caucasian patients. Our vision is to create a world in which EVERY patient can receive their life-saving cell therapy. Spreading awareness and growing the registry by joining our movement is something that college students, faculty and staff can participate in a variety of ways. Our new national partnership with Beta Beta Beta (TriBeta) Biological Honor Society that just launched in the fall 2023 provides low-lift and high-impact opportunities to be part of our life-saving educational and service activities.

8478 - Understanding diversification within the North American Coastal Plain through hybridization in pondweeds (Potamogetonaceae)

Zacc Ramm, Laura Frost

University of South Alabama, Mobile, AL

The North American Coastal Plain (NACP) in the southeastern United States was overlooked as a hotspot in multiple analyses of global biodiversity. The NACP exhibits particularly high freshwater biodiversity and is home to many endemic aquatic plant species; however, aquatic plants are typically under-collected and understudied. The pondweed family (Potamogetonaceae) is one of the most species-rich freshwater aquatic plant families in the world and contributes greatly to the submersed aquatic plant diversity in the northern hemisphere. Despite their dominance in freshwater ecosystems and ecological and economical importance in maintaining these systems, there is a lack of basic biological knowledge for these plants. One of the most basic barriers to further research is poor taxonomic resolution. Potamogeton has historically been one of the most difficult aquatic plant groups to describe and the genus is known to readily hybridize. It is estimated that there are as many if not more hybrids than distinct species. Hybrid species are often excluded from biodiversity assessments, either passively or explicitly. Given that hybrids greatly contribute to taxonomic diversity and taxonomic confusion, more robust identification hybrid species and their evolutionary origins will help resolve pondweed taxonomy and provide a more accurate assessment of biodiversity within the NACP. Geological processes that fragment species distributions, like glaciation cycles and sea level fluctuations, can facilitate speciation by reproductively isolating populations for thousands to millions of years. These processes can also bring species that did not previously geographically overlap together. In the case of Potamogeton, in which species readily hybridize where they co-occur, such events likely promoted diversification through both population fragmentation and new combinations of co-occurring species. I aim to identify hybrid taxa within Potamogeton and use them as evolutionary records of contact between species during glacial periods in order to better understand the evolutionary history of the NACP.

9351 - Female Mate Selection in Lepidopterans: Insights into the Role of Male Diet Composition and Its Impact on Reproductive Success

Nicole Lowder

Appalachian State University, Boone, NC

The reproductive success of female Lepidopterans is intricately linked to the dietary choices of their male counterparts, particularly the acquisition of salt—a vital nutrient not readily available in nectar. Male butterflies actively seek out salt by puddling along river banks and drying mud puddles, with these nutrients later integrated into the spermatophore and transmitted to females during copulation. Male fitness is gauged by their capacity to spread genetic information through mating with multiple females, while female fitness relies on the production of viable eggs, prompting a discerning approach to mate selection.

My study aims to determine whether female butterflies possess the ability to discern variations in male diet composition and adjust their mate preferences accordingly, directly influencing their fitness. *Vanessa cardui* specimens will be reared in a controlled environment and sexed before allocation to distinct feeding groups. Males will be randomly assigned to one of three treatment diets: sugar water solution (table sugar and water), saltwater solution (organic soil, sand, and water), and both sugar and salt water solutions. Females will all receive a diet of the sugar solution. After 24 hours of feeding, one male from each group will be placed in individual mesh chambers within a larger enclosure, alongside a free-flying female. Observations on visitation frequency will be conducted to determine if females exhibit a significant preference for mate choice.

This study addresses a critical gap in understanding female selection within Lepidopterans, an area largely overshadowed by extensive knowledge of male selection and diet-related contributions to offspring viability. As species decline, it's crucial to comprehend their dietary and life histories. Further research can be conducted to determine the pheromones and hormones used during this selection process.

8806 - Online Ecology Course Developed for Non-science Majors

Noel Cawley

Lincoln Memorial University, Harrogate, TN

The purpose of this course is to introduce non-science majors to ecology and science, an appreciation of the natural environment and its complexity will be emphasized. This course will introduce students to the deciduous ecosystem of Appalachia, focusing on biotic and abiotic components and species interactions within this system. This is a hybrid course that will have a field trip and several meetings at the beginning of the semester. Students will engage in two group projects, one will run all semester, the second will run for five weeks and students will gain experience in observational investigating, drawing conclusions from these observations, and explore the limitations of the project data. These projects will serve as the lab component of this course. The semester long project will consist of observations of *Marmota monax (*groundhog), where and when are they seen on campus. Students will work in groups and share their data, a final report will include locations, likely times present, and a population estimate of campus groundhogs. The second project, students will choose from a number of studies to participate in and collect data for four weeks, analyze that data and create a presentation that they will share using VoiceThread. Possible topics for the second project include pollinators in the rose bed, birds at the pond, squirrels below MANS building. Students will gain experience in observational investigating, drawing conclusions from these observations, and explore the limitations of the project data.

8848 - The fat bird gets the worm. Parental responses to nestling begging depend on nestling size asymmetries, developmental stage, and parent sex

Kelly O'Neil, Kelly Miller, Shelby Green, Madison Mash, E. Keith Bowers

University of Memphis, Memphis, TN

Parents optimize the tradeoff between current and future reproductive success by tempering investment in current young. They may bet-hedge against environmental variation by producing young who differ in size, creating a foundation for size-based preferential investment. Offspring influence parental feeding decisions by communicating their hunger and/or quality via begging signals. We cross-fostered subsets of nestling Carolina wrens (*Thryothorus ludovicianus*) from wild broods that were two days apart in age, creating ecologically relevant size asymmetries among siblings. For controls, we cross-fostered same-aged nestlings. We filmed nests during two developmental stages to quantify parent and nestling behaviors during provisioning events. Early in development, older nestlings received more food per begging effort and gained more mass compared to younger or control nestlings. Later in development, nestlings of all treatments were fed in proportion to their begging effort and did not differ in mass gained. However, nestlings that were relatively large compared to their siblings received more food per begging effort at both developmental stages, even though relatively small nestlings begged more overall. Both parents (but especially the male) provisioned more and were more responsive to begging in broods that received older nestlings. We demonstrate that food distribution among the brood is ultimately a compromise between nestling size asymmetries, begging behavior, and parental decisions. This study has implications on the adaptive value of within-individual variation in size asymmetry of broods produced.

8398 - The Socio-Ecological Role of Greenways in Urban Systems - REU Year 1 Update

DeAnna Beasley[1], Christopher Acuff[1], Shannon McCarragher[2], James Hanlon[2]

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The global human population is rapidly increasing and much of that increase is happening in cities. Because of this growth, cities face numerous distinct challenges related to their ability to maintain overall stability amid global change (e.g., climate change, globalization, pandemics, urbanization, etc.). Greenways serve as an interface between human and natural systems across urban environments and thus may serve as a means for enhancing urban resilience. As part of the SERGUS REU, undergraduate students conducted primary, interdisciplinary research and activities to assess the social and ecological drivers of microclimate and human usage patterns in urban greenways in Chattanooga, TN. They also explored how empirical evidence on urban greenways can inform local policy to design more resilient cities by mitigating negative environmental impacts and social disparities. Here, we present our preliminary findings on fine-scale microclimate variation, vegetation dynamics, and ant resource use along two major greenways in Chattanooga: The Riverwalk and the South Chickamauga Greenway. We also share how the SERGUS REU program introduced students to careers in local government and non-profit and how their research interests can inform such careers.

8554 - Canaries on the Coastline: Atlantic Ghost Crabs (*Ocypode quadrata*) as Bioindicators to Investigate Human Disturbance of Coastal Dunes

Chelsea Thornton, Taylor Clay, Aaron Wiggs, Jeremiah Henning

University of South Alabama, Mobile, AL

Within the past century, anthropogenic impacts have become the strongest force altering ecosystems worldwide, and the strength of these disturbances are primarily connected to human population size and intensity of land-use. Coastal ecosystems are experiencing the highest rates of population growth and sea level rise to other coastal regions in the country. Coastal dunes are dynamic ecosystems that receive intense natural disturbances of sand accretion and erosion necessary to maintain ecosystem function; however, there has been an increase in anthropogenic disturbances such as urbanization, tourism, trampling, sea-level rise, and habitat destruction. Indicator species are often used to accurately identify ecosystem-level responses to ongoing disturbance. For instance, the Atlantic Ghost Crab (*Ocypode quadrata*) is a common indicator species on the Eastern Atlantic and Gulf of Mexico coasts because of its widespread

distribution and sensitivity to natural and anthropogenic disturbances. We studied ghost crab density, burrow diameter, energy storage, reproductive success, stress hormone levels, and claw sizes to understand population dynamics in the face of human disturbance in 1) a mechanical disturbance x resource addition experiment established on Dauphin Island, AL, and 2) collecting ghost crab metrics across several beach locations along the Northern Gulf of Mexico. Based on our preliminary results on Dauphin Island, we found that there was little change in the burrow sizes across all treatment types, however, the average number of burrows were highest in the disturbed and disturbed + NPK plots, suggesting that the crabs preferred more open plots with less vegetation. These findings suggest that ghost crabs can potentially tolerate intermittently low-level physical disturbance and rebound quickly when in an ideal micro-habitat.

8951 - *Chelone obliqua var. erwiniae*, a poorly understood endemic.

Aster Ayer

Western Carolina University, Cullowhee, NC

Chelone obliqua var. erwiniae Pennell and Wherry (Erwin's turtlehead, Plantaginaceae) is a member of the Chelone obliqua complex, a group of three similar taxa that all arose from hybridization. The other two C. obliqua taxa are both hexaploid, whereas var. erwiniae is tetraploid. It has been hypothesized that each of these taxa have separate origins from independent hybridization events. While other research is being done on taxonomy of this whole group, I have focused on the issues facing var. erwiniae, such as morphological overlap with other locally occurring Chelone taxa, morphological variations between populations of this entity, and the presence of populations appearing to be this taxon outside of its currently accepted range. Chelone obliqua var. erwiniae is a showy native plant, however it is often overlooked as Chelone identification can often be difficult. Within the literature, var. erwiniae is described as being a narrow endemic of the North and South Carolina Blue Ridge. However, plants within a contiguous range that appear to be var. erwiniae can be found into northeastern Georgia and more widely distributed in NC and SC. I intend to find evidence to show that these populations are all members of this taxon through meiotic chromosome counts to determine ploidy and morphological analyses. I have begun documenting variations in corolla and staminode color and leaf width to length ratios across this proposed expanded range. Additionally, I am attempting to find ways to reliably distinguish this species in the field vegetatively from peripatric Chelone glabra.

9287 - The effects of *Batrachochytrium dendrobatidis* supernatant on locomotor performance in an aquatic frog, *Xenopus laevis*

Anna Lennon[1], Louise Rollins-Smith[2], Chase Kinsey, PhD[1]

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Chytridiomycosis, an infectious disease caused by the skin fungus, *Batrachochytrium dendrobatidis* (*Bd*), is a major contributor of declining amphibian populations over the past thirty years. The fungus disrupts the ion exchange on the frog skin leading to decreased body mass, righting reflex, and locomotor performance. However, the physiological mechanisms directly impacting locomotor performance are unknown. Given the negative effects on locomotor function and movement in infected species, it is hypothesized that the fungus produces a neurotoxin during its lifecycle. This study aims to determine the potential neurotoxicity and the equivalent dosage of *Bd* supernatant leading to locomotor decline in an aquatic frog, *Xenopus laevis*. Although *Xenopus* are highly resistant to the effects of *Bd*, previous literature has provided a dosage that induces mortality, which serves as a baseline to test concentration and neurotoxicity. Frogs were injected with *Bd* supernatant with comparable cell counts to a mortality inducing dosage. After four hours, frogs were filmed performing an escape response with high-speed cameras. The film was digitized in MatLab using a DLT Dataviewer script to determine escape velocity. Changes in locomotor performance when compared to previous literature may provide further insight into the mechanisms affecting neuromuscular performance of infected *Xenopus laevis*.

8692 - Basketweaving for Biology (or: Biology for Basketweaving?)

Amy Boyd

Warren Wilson College, Asheville, NC

Applying biological concepts to real-world applications is a great way to enliven courses and generate or build upon student interest. Though "basketweaving" has been used as a joking way of talking about "classes that are easy and fairly useless", it's a craft with a long and rich history worldwide. Understanding plant anatomy can inform use of materials in basketweaving, and understanding how materials work in basketweaving can support and enrich basic studies of plant anatomy. I engaged my General Botany students in collecting invasive plant materials (english ivy) from our campus and using it to create simple baskets. In the process, we applied learning about plant molecules, tissues, and stem structures, and discussed the ways in which the properties that make certain molecules, tissues and structures well-suited to certain plant organs *also* lends themselves to particular applications in basketweaving. I'll share the story of our adventure and the outcomes.

9107 - Avian Studies at Georgia Gwinnett College, located in a Suburb of Atlanta, Georgia

Mia Malloy

Georgia Gwinnett College, Lawrenceville, GA

The Georgia Gwinnett College (GGC) Bird Lab has been conducting avian research in Lawrenceville, Gwinnett County, a suburb of Atlanta, GA, since 2017. The GGC Bird Lab arose from an upper-level course, called Experimental Methods. The GGC Bird Lab faculty also provide one-on-one guidance with students to conduct individual research in a course, called STEC. Experimental Methods is a research-embedded course and a capstone for seniors that ensures they are comfortable with applying all of the steps of the scientific

method by conducting an experiment. Led by the faculty of the GGC Bird Lab, the Experimental Methods course, allows students to conduct research by stepping into an established, long-term monitoring study of avian diversity in Gwinnett County, GA. The overarching goal of the project is to determine whether this loss of habitat affects bird biodiversity. Urbanization is rapidly increasing in Gwinnett County, making areas around GGC campus the perfect study sites. Many previous studies have shown a strong negative correlation between urbanization and biodiversity. Interestingly, our data at this point indicate that the effect of urbanization on overall species biodiversity varies, but does negatively affect genetic diversity. This year, with the acquisition of new audio recording equipment, research goals for the lab will expand to include the effects of anthropogenic noise on bird song.

9157 - Pollination Energetics in a changing climate.

Hannah Wright, Jennifer Geib

Appalachian State University, Boone, NC

Data has accumulated worldwide for range shifts, range contractions, and population declines among native bee species. Climate change is one of the many factors contributing to this pollinator crisis. Environmental shifts such as warming and drought limit floral food resources and habitat availability, facilitate novel competition for resources as species ranges shift, and can also result in phenological mismatches between plants and their pollinating counterparts. Stressed plants produce smaller floral displays and lower quality floral rewards, in turn making foraging a longer and more energy intensive process for pollinators. My research aims to explore the impacts of climate change conditions on pollination energetics during the foraging process. I will use an infrared camera and gas exchange system to evaluate the energetic cost:benefit ratios of pollinators foraging in a temperature controlled environment. I will test the hypothesis that higher environmental temperatures will result in higher rates of cellular respiration in pollinators by observing infrared images of bees foraging in normal temperatures compared to those foraging in higher temperatures, consistent with IPCC predictions from the 2023 synthesis report.

9200 - Genomics Education Partnership - Opportunities for Incorporating Genomics Research In Undergraduate Biology Classes

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The Genomics Education Partnership (GEP) is a nationwide collaboration of institutions that integrates active learning into the undergraduate curriculum through Course-based Undergraduate Research Experiences centered in bioinformatics and genomics. We will present opportunities for engagement with the Southeastern Node of the GEP, and highlight the current research projects including The Pathways Project, which uses network analysis approaches to explore the evolution and function of biological pathways. We will discuss how GEP projects can be used in various institutional settings, including two and four-year private and public colleges.

8759 - Two Biotic Factors Contributing to the Decline of Native Seagrasses in Puerto Rico

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Seagrass populations from two sites within Jobos Bay (Aguirre, Puerto Rico) have been monitored bi-annually (winter and summer) most years from 2019 – 2023. These monitoring sites were selected because of an initial dominance of the native seagrass, *Thalassia testudinum* (turtle grass). Each site has 20 quadrats each, with one site located adjacent to a basin mangrove forest and the other on the leeward side of a fringe mangrove forest. The invasive seagrass *Halophila stipulaceae* was initially at 23% cover at the basin site when first measured in 2019, but not at the fringe site. It first appeared at the fringe site in January 2021 and has continued to increase at both sites. Additionally, the shallower quadrats at the fringe site have experienced a noticeable decrease in *T. testudinum* cover since July of 2021. This decrease in *T. testudinum* could be a result of recent seasonal accumulation of floating brown algae, *Sargassum* spp., in the shallow areas of this site. The accumulation of this algae and the increased growth of the invasive seagrass are likely negatively impacting native seagrass and macroalgae populations throughout the Caribbean. The goal of this research is to estimate the role each biotic factor has in the fluctuation of native macrophytes in the region.

8562 - The Relationships Among Tick Abundance, Tick-Borne Disease Prevalence and Habitat Conditions Throughout the State of Alabama

Ayaan Dani

University of South Alabama, AL

In Alabama, Spotted Fever Rickettsiosis (SFR) has shown an increased incidence without a known vector. *Amblyomma maculatum* and *Dermacentor variabilis* ticks and associated pathogens do not account for the abundance of cases of SFR. *Ambylomma americanum*, the most commonly found tick in Alabama, and its associated pathogen, *Rickettsia amblyommatis,* may be able to enlighten this situation.

Ticks were collected from Alabama's 22 state and historical parks by using a standard dragging procedure for 3 hours at each location. Drags were checked approximately every 20 meters with collected ticks preserved in 95% ethanol. Each tick was sorted by location, date, life stage, sex, and species. Data loggers will be placed every 100 meters up to 500 meters along trails to collect temperature and relative humidity. Data will be collected three times over the summer, fall, and winter seasons. Collected ticks will then be screened for

selected diseases including SFR through qRT-PCRs. Tick and pathogen data collected is being used to develop models describing the spatial, temporal, and ecological factors contributing to the transmission of SFR in Alabama.

Ticks collected thus far have totaled 301, approximately 76% of those ticks are *Amblyomma americanum.* Only 4% are *Ixodes scapularis,* 4% are *Amblyomma maculatum,* and 16% *Dermacentor variabilis.* Ticks are currently undergoing lab preparation to begin processing for diseases.

8890 - Facilitative and competitive interactions among dune grass species in stressful and low stress environments

Anne Sciolino, Julie Zinnert

Virginia Commonwealth University, Richmond, VA

Coastal dunes are imperative to the protection and preservation of inland ecosystems. However, due to global warming, seal level rise, and coastal development, coastal dunes are under constant threat of destruction. Restoration efforts have been implemented to rebuild the protective function of dunes through the planting of dune building grasses. However, little is known about the facilitative and competitive relationship among dune grasses. In order to maximize restoration efforts, research is needed to better understand the biotic interactions among restorative grass plantings. This research will provide coastal managers with planting designs that maximize the success rate of dune grass establishment and success. We will quantify facilitative and competitive relationships through plantings of *Ammophila breviligulata*, *Panicum amarum, Spartina patens,* and *Uniola paniculata* within interspecies and intraspecies plots along a stress gradient. We hypothesize that positive facilitative interactions will be observed among interspecies plantings in stressful environments due to habitat amelioration, and negative competitive interspecies and intraspecies interactions will be observed in the lower stress environment. On Hog Island, a Virginia barrier island, dune grasses will be planted in areas of high stress and low stress and growth will be monitored throughout the growing season to determine potential facilitative and competitive interactions. A greenhouse study will determine the role of belowground interactions through root exclusions**.** With the current low success rate of planted dune building grasses, this research is highly significant. This new understanding of how dune grass species interact in interspecies and intraspecies plantings in stressful and lower stress environments will allow coastal management practices to re-evaluate how they plant restorative dune building grasses.

8821 - Everything wrong with science in five minutes, I promise.

Patrick Cain

Defiance College, Defiance, OH

Science is a human-created tool that helps us understand the natural world. It is not without flaws, but one of the most important qualities of science is that such flaws can be addressed. Here, I discuss several modern flaws in science that preclude our noble pursuit of knowledge, and ways they can be addressed.

8594 - The Time to Act is Now: Advocating for higher education as a public good we must protect

Jill Penn

Georgia Gwinnett College, Lawrenceville, GA

The escalating crisis in higher education is undermining the abilities of biologists to produce knowledge and contribute to teaching and research and the health and welfare of society. Disciplines in the arts and sciences that provide knowledge, instruction, and expertise are collapsing as a result of decades of reduced public funding; take-overs of governance by legislatures and governors; the closure and merging of academic departments and elimination of majors and degrees; threats to tenure; and the reliance on low-paid, contingent instructors for over 75% of all teaching.

The impact on professional organizations is profound. The shift to overwhelmingly contingent labor has resulted in professional organizations losing their dues paying members and seeing fewer participants in their conferences and subscribers to their publications. The diminishing numbers of faculty who have the resources and time to engage in peer review, whether for publication or tenure, is also creating a crisis in the production and sharing of disciplinary knowledge

Now is the time for professional disciplinary organizations to take leadership roles in educating their members and the public about the crisis, and in expressing support for policies that support the survival of the profession. For decades, public higher education has been one of the country's most important democratic and economic institutions. The current crisis is an enormous and universally relevant social setback, one which it is our right and obligation to oppose.

9197 - Hurricane Creek Fish IBI Pre and Post Habitat Restoration

Kimberly Nguyen, Andrew Taylor, Danyelle Dehner

University of North Georgia, Dahlonega, GA

The Etowah River Basin of northern Georgia is home to a rich biodiversity of aquatic species, including serving as a stronghold to the federally endangered Etowah Darter (Etheostoma etowahae). The area of study within the 2 kilometers of the main stem of Etowah river runs along the river, separated by isolated ridges, until meeting at the confluence. The University of North Georgia acquired the

land in 1981 which includes the Hurricane Creek tributary of the Etowah River. The land sat overgrown and unused until the University began several landscape-restoration efforts within the past few years. To monitor potential effects of the restoration efforts on the fish community, our team conducted an Index of Biological Integrity (IBI) both before (2017) and during (2023) restoration efforts on the property. Fish community sampling was done with Georgia DNR (Department of Natural Resources) personnel using standard operating procedures for backpack electrofishing. IBI scoring followed DNR guidelines. The comparison of the two data sets showed that the IBI score had decreased by 4 points meaning that some unknown factors caused a loss in diversity within the area. We hypothesize that increased human development Northeast Georgia could be a contributing factor, but further study is needed.

BBB Talks

142 - Prevalence of Antibiotic Resistant Bacteria in the Holston Watershed: A Seasonal Analysis of Variability

Rachel Turner

Emory & Henry College, Emory, VA

Overuse of antibiotics in medical, veterinary, and agricultural industries has led to increased discharge of antibiotics into the surrounding environment which can pose a risk to human health. During the summer, winter, and spring seasons of 2022-2023, levels of bacterial antibiotic resistance were analyzed from three recreational and two wastewater treatment plant locations within the Holston watershed of northeast Tennessee. Microbial sensitivity to 12 antibiotics used in human/veterinary medicine was evaluated following the Kirby-Bauer Disk Diffusion method. We hypothesized fluctuation in antibiotic resistance across sampling sites due to seasonal rainfall/runoff events, and higher resistance in locations downstream of wastewater treatment plants correlated with plant overflows. Data from each sampling period indicates a high prevalence of antibiotic resistance in the Holston watershed. Thirty-five percent of all isolates (n=224) were resistant to four or more antibiotics, and 21% were resistant to 6 or more antibiotics. Additionally, upstream and downstream locations of both wastewater treatment plants exhibited higher occurrences of satellite colonies on Kirby-Bauer Disk Diffusion antibiotic susceptibility testing indicating that antibiotic resistance genes are evolving. We also observed an increased level of microbial resistance to Chloramphenicol, Erythromycin, Tetracycline, Amoxicillin, and Ampicillin from samples collected in the spring of 2023 compared to sampling from 2022. Both wastewater treatment plant sites displayed similar patterns of resistance and susceptibility between upstream and downstream samples, indicating the treatment process does not appear to affect the prevalence of antibiotic resistant microorganisms. We interpret that periods of seasonally high rainfall contribute to influxes of enteric bacteria in the Holston watershed through agricultural runoff. Rainfall events also contribute to increases in wastewater facility failures which provide another mode of contamination to the recreational water sites. These data are concerning due to the high volume of human recreation at each sampling site and associated risk of waterborne infectious disease transmission.

143 - Does the age and sex of raccoons (*Procyon lotor*) relate to distance and speed of movement in southwestern Tennessee?

Laura Minter[1], John Hisey[1], Liam Catron[2]

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Raccoons are prominent pests as well as the principal wildlife carrier of rabies, and are, therefore, key to controlling the spread of this disease. Annually, the United States spends over $600 million on the control of rabies. Although poorly understood, knowledge of rates of dispersion related to sex and age of raccoons in the southern US are critical for effective raccoon control. Our null hypotheses are that there are no differences in distance and speed traveled between the different sexes nor among age classes. Our study encompassed 11 years and 96,000 live-trap-nights in six grids across multiple habitats totaling 13.8 km^2 in southwestern Tennessee. Microsatellite genetic analysis of 440 of our captured raccoons yielded 282 observations of 124 individuals (28.2%) in first-order relative pairs (IFRP). These included 30 observations (10.6%) comprising 9 individuals in 5 pairs that all included at least one male and that were separated by greater than 68,000 meters at rates of up 34,560 meters per year. Data from the five most closely clustered grids, spanning less than 13,000 meters, yielded 106 observations of first-order relative pairs. From these pairs, observations of distance and speed of separation of male-only pairs (n=51; =2520.21 m; 705.98 m/yr) vs female only pairs (n=13; =447.55 m; 150.57 m/yr) yielded Mann-Whitney U test (MWU) p=0.00359 (distance of separation) and p= 0.00993 (speed of separation). Observations of the distance and speed of separation of the youngest (ages 0-38 months) pairs (n=26; =4673.47 m; 2,153.64 m/yr) vs older (ages 39-111 months) pairs (n=22; =1551.0 m; 621.18 m/yr) racoons yielded MWU p= 7.84E-06 (distance of separation) and p= 0.0216 (speed of separation). These novel findings failed to support any of our null hypotheses because distance and speed of dispersion differed by sex and age and should inform raccoon control strategies.

144 - A Comparison of Antibiotic Resistance Levels in Feral, Semi-Feral, and Domesticated Horses

Sarah Walters

Emory & Henry College, Emory, VA

The horse's gastrointestinal tract exhibits a wide variety of bacteria. However, due to widespread use of antibiotics for both prophylaxis and treatment of infection, many bacteria have evolved resistance, sometimes to multiple chemotherapeutics. We assessed prevalence and degree of antibiotic resistance present in fecal isolates from feral, semi-feral, and domesticated horse herds located in Shackleford Banks, North Carolina; Linton, North Dakota; Corolla, North Carolina; Grayson Highlands State Park in Virginia; and Bristol, Virginia. Kirby-Bauer Disk Diffusion antibiotic susceptibility testing was performed on isolates from each population utilizing 18 commonly prescribed antibiotics. It was hypothesized that a correlation between increased antibiotic resistance and higher degrees of human contact would be observed.

Sampled isolates from all five populations were resistant to the same four antibiotics. Shackleford isolates were susceptible to 10 of 18 antibiotics tested; North Dakota isolates were susceptible to 8 of 18 antibiotics tested; Corolla isolates were susceptible to 8 of 18 antibiotics tested, Bristol isolates were susceptible to 7 of 18 antibiotics tested, and Grayson Highlands were susceptible to 6 of 18 antibiotics tested. Higher levels of intermediate susceptibility were present in the North Dakota and Grayson Highlands populations compared to others but followed similar trends. Although higher resistance levels in the Grayson Highlands population were observed compared to the Bristol population, despite the Bristol population receiving higher levels of human contact, this could be explained by resistance mitigation efforts employed in the domestic population. Our hypothesis was supported across the other populations.

145 - Real-life Zombies: Cordyceps in our Backyard

Daniel Ruiz

Catawba College, Salisbury, NC

Invoking horrors reminiscent of apocalyptic tales, Cordyceps, a parasitic fungal genus extensively documented for its ability to infect a wide variety of insects and arthropod hosts. The success of this parasitic fungus is attributed to manipulating the host's behavior, often favoring survival and reproduction, with fatal determent to the host (De Bekker et al., 2014). Such behavior is exhibited through phenotypic attributes, such as a "death grip" that involves fungal chemical manipulation of the host that directs them to climb up vegetation and anchor their mandibles to the underside of a leaf stem, or twig. Once in its final resting place, the fungus continues to flourish from within, eventually sprouting fruiting bodies from the host (Lin et al., 2020). Among this diverse array of hosts, *Camponotus spp.*, commonly known as carpenter ants, have been found within Catawba College's Ecological Preserve that have been infected by suspected Cordyceps. Carpenter ants have been found parasitized within the temperate woods of South Carolina by a fungus, in this case the species was later named after the citizen scientist who discovered the fungus as *Ophiocordyceps unilateralis kimflemingiae.* In this study, we first aim to identify the fungal species capable of infecting local *Camponotus spp.* hosts on the Catawba College campus using ITS barcoding in addition to spore characterization and fungal morphology. Furthermore, future work will explore the potential effects of varied microbiomes on the ability of *Cordyceps spp.* to establish infection on specific host species vs. non-host species using 16S Metagenomic analysis.

146 - Interdependence of the components of the nociceptive withdrawal response in intact rats

Ellie Raterman

James Madison University, Harrisonburg, VA

Animals depend on withdrawal responses to noxious stimuli for their survival, such as the nociceptive withdrawal response (NWR), which can be evoked in rats by cutaneous stimulation. The NWR has been thought of as a singular movement with the purpose of protection, but recent studies emphasize that the NWR consists of multiple components. Our laboratory found that in response to a noxious stimulus in intact rats, there were three distinct sequential phases of movement; however, little is known about their interdependence. The goal of this study was to characterize the phases of NWR and their interdependence. The NWR in male Sprague-Dawley rats (n=17) was evoked using localized noxious heat stimulation (980nm laser) delivered to the foot, either briefly (0.5s) and near threshold, or continuously at various intensities. The response was captured using high-speed video (500fps). The iliac crest, hip, knee, ankle, 5th metatarsophalangeal, and 2nd toe were marked and tracked over time to provide the magnitude and direction of movement for each anatomical landmark and allow for calculation of hip, knee, ankle, and toe joint angles. In response to brief stimuli near threshold, phase 1 never occurred without the succession of phase 2, and phase 2 rarely (3%) occurred without phase 1. Further, phase 3 always followed phase 2. In response to continuous stimulation, there was no correlation between latency and time difference (p=0.3) for the first two phases, suggesting they cannot be temporally dissociated. Additionally, there was a strong, positive correlation (p<0.001) between the magnitudes of these phases, further suggesting association. Our results demonstrate the three phases of the NWR could not be disassociated, indicating that these phases are integrated into a singular response. Our results support a complex understanding of the NWR, suggesting the NWR is a multiphasic response that incorporates postural adjustments, preparatory responses, and withdrawal.

147 - Exploring Caspofungin Unmasking in *Candida auris* to Enhance Macrophage-Mediated Antifungal Immunity

Bradley Akin, Logan Baker, Oscar Arellano

Mercer University, Macon, GA

A major challenge in detecting *Candida auris*, a multi-drug-resistant fungal pathogen in the human body, is its ability to evade the immune system through a cell wall-masking mechanism. Caspofungin is an antifungal agent that disrupts the synthesis of ß (1-3)-glucan, a critical cell wall component that interacts with macrophages to identify and eliminate these pathogens. In this study, we used sublethal caspofungin levels to disrupt this masking, exposing beta-1,3-glucan to the dectin-1 receptor found on macrophages. After a 3-hour incubation with caspofungin, we added anti-beta-1,3-glucan antibodies to evaluate the presence of beta-1,3- glucan in the cell wall. Next, each unmasked strain is incubated with macrophages, and lactate dehydrogenase concentrations are measured using the CytoTox 96® Non-Radioactive Cytotoxicity Assay kit. Additionally, we quantify the number of *C. auris* destroyed by macrophages using a macrophage-killing assay. Preliminary data from our study indicate that macrophages exhibit enhanced phagocytic activity against unmasked *C. auris* strains following caspofungin treatment. These findings suggest that targeting the mannan layer to expose beta- 1,3-glucan may represent a promising strategy for enhancing the host immune response against *C. auris*, potentially opening up new avenues for therapeutic interventions in combatting this drug-resistant fungal pathogen.

148 - Potential Role of Adenovirus E4 11k Protein Toward the Inhibition of Interferon-beta Expression During an Infection

Elizabeth Seidita[1], Camille Browning[2], Madison Germain[1], Jada Lynn Ginn[3]

[1]Georgia College & State University, Milledgeville, GA, [2]Georgia College & State University, Milledegeville, GA, [3]University of Georgia, Athens, GA

Adenoviruses are double-stranded DNA viruses that cause common upper respiratory infections. Early viral proteins will generate an ideal environment to promote viral replication. An early viral protein, E4 11k, has multiple functions, including the redistribution of

PML nuclear bodies and cytoplasmic p bodies, leading to a potential alteration of their functions. The cell will attempt to respond to viral infection through nucleic acid sensors, such as RIG-I, that will induce type I interferon transcription, which can lead to an inhibition of viral replication. Retinoic-acid inducible gene I (RIG-I) is a viral RNA sensor that activates a signaling cascade to stimulate a type I interferon response. DEAD-box helicase 6 (Ddx6) was recently shown to bind to RIG-I to enhance its functions. E4 11k has been shown to colocalize with and bind to Ddx6, causing Ddx6 to go into aggresomes. Influenza and EV71, single-stranded RNA viruses, have also been shown to interact with Ddx6, leading to the modulation of RIG-I. Therefore, we hypothesize that E4 11k is binding to Ddx6 to modulate RIG-I, leading to a decrease of expression of interferon-beta. Human cells were infected with an Ad 5 wild-type virus and an E4 11k deleted virus for 12, 24, 30, 36, and 48 hours, and RT-qPCR was performed to evaluate expression of RIG-I and interferon-beta. When the expression of RIG-I and interferon-beta was normalized to GAPDH, an internal control, we found that a biphasic expression of both RIG-I and interferon-beta was present during the wild-type infection with peaks at 24 and 36 hours post infection (hpi) and decreases at 30 and 40 hpi. When E4 11k was not present, a similar expression pattern occurred; however, there was a sustained increase of interferon-beta expression present after 36 hpi, suggesting that E4 11k is necessary toward the reduction of interferon-beta expression.

149 - Indole-3-carbinol can rescue Lipopolysaccharide-induced cytotoxicity in small intestinal epithelial cells: implications for necrotizing enterocolitis

Arlo Colvard

Lipscomb University, Nashville, TN

Necrotizing enterocolitis (NEC) is a gastrointestinal disease that primarily affects premature infants. It is responsible for the majority of gastrointestinal tract-related neonatal intensive care unit admissions and costs the United States healthcare system an estimated one billion dollars annually. NEC pathogenesis is dependent upon Toll-like receptor 4 (TLR4) signaling, which can be blocked by pretreatment of aryl hydrocarbon receptor (AhR) ligands. TLR4 signaling results in excessive apoptosis, compromising the epithelium of the gastrointestinal tract and disrupting the physical barrier between the lumen of the intestine and the underlying tissue. This allows for microbial translocation, necrosis, and sepsis. Dietary tryptophan (Trp) is converted into kynurenine by the host enzyme indoleamine 2,3-dioxygenase (IDO-1) or can also be metabolized by commensal microbes into AhR ligands. In many inflammatory diseases, Trp metabolism is skewed toward the IDO-1 pathway at the detriment of the AhR pathway. Here, we hypothesize Trp metabolism is also dysregulated in NEC. To model NEC in vitro, we treated rat intestinal epithelial cells (IEC-6) with the TLR4 ligand lipopolysaccharide (LPS) for a period of 6 or 24 hours. Through quantitative RT-PCR we found no effect of LPS treatment on IDO-1 expression at either time point, but saw a significant reduction in AhR expression at both time points. However, LPS pretreatment did not block the ability of indole-3-carbinol (I3C), an AhR pro-ligand, to activate AhR. Through MTT assays, we found that I3C can rescue LPS-induced cytotoxicity. Our preliminary data show that LPS can reduce AhR expression but not activity and suggests provision of AhR ligands can restore epithelial cell health and therefore are potential novel NEC therapies.

150 - The Effects of the Pesticide Acephate on PG19 Mouse Amelanotic Melanoma Cells

Kaley Kuhaneck

Mary Baldwin University, Staunton, VA

The pesticide Acephate is commonly used across the United States as a popular insecticide. The U.S. Environmental Protection Agency classifies Acephate as a possible human carcinogen. Other studies have addressed the possible carcinogenicity of Acephate in living mice and other cell lines, but none have evaluated the amelanotic mouse melanoma PG19 cell line. PG19 cells were used to evaluate the effects of Acephate because individuals most at risk of exposure to Acephate are also at risk of developing melanoma. The effects of short-term exposure to various concentrations of Acephate (10, 100, and 1000µg/ml) were investigated on PG19 cells through trypan blue exclusion cell viability and scratch wound healing assays. Based on experimental evidence, treatment with Acephate was expected to increase proliferation and migration rates indicating a role in carcinogenesis and metastasis within a PG19 melanoma cell model. Treatment with Acephate resulted in significant decreases in cell viability of PG19 cells at 24 hours. Exposure to 1000µg/mL of Acephate had a cytotoxic effect. At 24 hours, there were no significant differences in scratch wound width between Acephate treatments. Comparison and evaluation of the mechanisms of previously published findings of pro-carcinogenic effects in longer-term assays compared to the cell toxicity in the short-term experiments performed in these studies is important in determining the risk assessment of the continued usage of Acephate in the United States.

BBB Posters

BBB1 - Enhancing Antimicrobial Efficacy and Biofilm Inhibition Using Nanomaterial-Based Coatings on Medical Devices

Deborah Roh, Sanjeevini Nalla

Mercer University, Macon, GA

Fungal infections present significant challenges to human health, and the development of highly effective, biocompatible antimicrobial agents is an urgent problem to be solved. However, the rise of drug-resistant fungi and antibiofilm development have shown limited efficacy, highlighting the need for novel solutions. Recent studies show the antimicrobial potential of two-dimensional (nano)structured MXene-based composites (Ti_3C_2Tx), which may possess the ability to damage bacterial membranes and generate oxidative stress. With rapidly growing resistance to current medications, bacteria like *Candida albicans* require this method of early cell targeting before irreversible biofilm attachment. This study examines the short-term biofilm inhibition of *C. albicans* on modified surface materials through coatings of MXene. Both BioMed Clear Resin and TPU material coupons are sprayed with a layer of MXene coating. *C. albicans* are incubated with the MXene-sprayed samples in RPMI media to measure the cell adhesion by a colony counting assay after 6 and 24 hours. Viability is analyzed through a Trypan Blue live/dead assay and reactive oxygen species (ROS) assay, using 2',7'-dichlorofluorescin diacetate (DCFH-DA) with microscopy images. The results show that modified-surface coupon samples inhibit *C. albicans* growth and biofilm formation by limiting initial adherence. This finding suggests MXene-coating on 3D materials as a potential avenue to address fungal biofilm formation and drug resistance, paving the way for innovative antimicrobial agents in medical devices such as dental implants or prosthetics.

BBB2 - An In-Silico Translation and Transcription Start Site Enrichment Analysis of the Abiotrophia defectiva Genome

Eric Foreman, Olivia Noble, Zackary Childs

Mercer University, Macon, GA

Abiotrophia defectiva is a gram-positive, cocci bacterium that is implicated in endocarditis. Using the NCBI-acquired genome of *A. defectiva*, the translation start sites, gene ontologies, and pathways were analyzed to understand its 1,830 coding genes and the 476 genes previously determined to be involved in pathways. Known binding motifs for sigma factors 70 (TTGACA and TATAAT) and 35 (CTGGNA and TTGCA) were probed in the genome and were collected if in proximity to the coding genes. Using Geneious Prime, a multiple sequence alignment was performed using Fast Fourier Transform (MAFFT) software followed by the creation of phylogenetic trees to further analyze the genes. To understand the arrangement of the genes within the phylogenetic tree, patterns of nodes were investigated further for any significant trends. Translation start sites of genes within each node were aligned to determine consensus sequences. Each node of the tree was analyzed by the percentage of genes involved in each pathway known to be present in *A. defectiva.* Using BioCyc Pathway Tools, an enrichment analysis was conducted on each colored node. Results reveal that the overrepresented pathways discovered are involved in the production of products required for DNA, RNA, and phospholipid synthesis, amino acid degradation, and ATP synthesis and degradation. This study provides further knowledge of the *A. defectiva* genome and its promoters, which allows for a better understanding of its operons and pathways. It also exposes a correlation of function between genes with similar binding motifs and start sites.

BBB3 - The Role of Adenovirus Protein E4 11k in P Body Protein Relocalization

Heather Vincent, Sarah West, Danny Robinson

Georgia College and State University, Milledgeville, GA

Adenovirus serotype 5 (Ad5) is a double-stranded DNA virus that can cause upper respiratory infections and conjunctivitis. One of the viral proteins, E4 11k, supports early viral infection by promoting late gene expression. E4 11k has been shown to disrupt cellular function by relocalizing processing body (p body) proteins to cytoplasmic aggresomes. Aggresomes are perinuclear formations that are sites of misfolded protein storage and only arise when there is cellular stress. The scaffolding p body protein, Ddx6, has been shown to colocalize with E4 11k in aggresomes during a wild-type Ad5 infection. Ddx6, however, was not relocalized to chemically induced (cadmium chloride-treated) aggresomes. This suggests that E4 11k is necessary for the relocalization of Ddx6. We observed the localization of additional p body proteins, Lsm1, Edc3, and Pat1b, in human lung carcinoma cells following wild-type Ad5 infection and cadmium chloride (CdCl2) treatment. E4 11k has been shown to reorganize Lsm1 and Edc3 to aggresomes and increases cytoplasmic Pat1b foci. Lsm1 and Edc3 were relocalized to both infection and chemically induced aggresomes. Pat1b was not relocalized to either infection or chemically induced aggresomes, however, the number of cytoplasmic foci increased under both conditions. To further characterize the role of E4 11k in p body localization, we infected with E4 11k only, L103A mutant, and D105A-L106A mutant viruses and observed the localization of several p body proteins. Currently, the ability of L103A and D105A-L106A mutant viruses to induce aggresome formation has not been studied. The L103A mutant cannot oligomerize but has the ability to dimerize. Preliminary results indicate that oligomerization is not required for infection induced aggresomal formation. E4 11k was found in aggresomes during an L103A infection, however, Ddx6 was not. The significance of this study is to understand better the dynamics of p body and aggresome formation in human cells.

BBB4 - Investigation of the ability of aryl hydrocarbon receptor activation to rescue LPS-induced cytotoxicity in small intestinal epithelial cells

Gabriella Longoria

Lipscomb University, Nashville, TN

Necrotizing enterocolitis (NEC) is a disease characterized by intestinal necrosis, inflammation, and oftentimes death. A disease primarily of premature infants, NEC affects 77% of infants born at ≤ 32 weeks. Previous studies suggest that Toll-like receptor 4 (TLR-4)-induced apoptosis of intestinal epithelial cells is required for NEC development. TLR-4 signaling has been shown to be downregulated by activation of the ligand dependent transcription factor aryl hydrocarbon receptor (AhR). Treatment with the AhR pro-ligand indole-3-carbinol prevents NEC in a mouse model, but it is unclear if AhR ligands can be used to treat, not just protect against, NEC. Our experiments investigated the effect I3C administration had on the viability of rat intestinal epithelial cells (IEC-6). We treated IEC-6 cells with the TLR-4 ligand LPS for 24 hours to model NEC *in vitro* and followed it by either a 6 hour or 24 hour I3C treatment. As a control, some cells were given PBS instead of LPS or DMSO instead of I3C. Following treatment, an MTT assay was conducted to evaluate cell viability. We found that the cells treated with both LPS and I3C had no significant difference in cell health compared to the cells treated with LPS and DMSO. These MTT assay results were consistent for both cells that received a 6 hour or 24 hour I3C treatment. Our results are not consistent with the hypothesis that AhR ligands can treat NEC. We are currently testing the ability of I3C to reverse LPS-induced cytotoxicity using other methods of measuring cell viability.

BBB5 - Immunogenicity of Codon-Optimized Vaccines for Hepatitis C

Taylor Peach, Jorggedyg Castillo-Perez, Jessica Bryndal

Northern Kentucky University, Highland Heights, KY

We are developing novel DNA-based vaccines for Hepatitis C virus (HCV). Fifty-eight million people worldwide are chronically infected by HCV, and there is no current vaccine. Our DNA-based vaccines target the three structural proteins of HCV (Core, E1, and E2). Expression of the HCV targets was verified in human cells after exposure to the vaccines, and ongoing experiments will determine the extent of immune activation by these newly developed DNA-based vaccines. These results may lead the way for developing a vaccine that can be used around the world to prevent HCV. In our study focused on viral vector usage, codon-optimized genes for the 3 structural proteins of HCV (Core, E1, and E2) were cloned into a non-replicating vaccine vector based on herpes simplex virus. The expression and immunogenicity of the HCV targets was examined in human cells. We hypothesize that the HCV proteins expressed by the new HCV vaccines will promote protective immune responses. These vaccines may stop the spread and harmful effects of Hepatitis C virus.

BBB6 - Developing Small Molecule Inhibitors for Controlling *Candida albicans* Infections

Kayna Kambou[1], Shreya Sudakar[1], Emma Teng[1], Jalisa Williams[1], David Goode[2], Sahar Hasim[1]

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Candida albicans, a naturally occurring yeast in the healthy human microbiome, can lead to infection if its growth becomes uncontrolled or spreads into the human bloodstream. In recent years, *C. albicans* has become increasingly resistant to many conventional antifungal treatments, which are already limited in number, resulting in adverse outcomes for patients who are immunocompromised or susceptible to bloodstream infections. A major contributor to *C. albicans'* resistance lies in its ability to form biofilms—dense aggregates of cells that adhere to solid surfaces, including medical instruments, implants, and prosthetics. To address the clinical challenge of treating biofilm-associated infections, our research focuses on screening large, chemically diverse compound libraries synthesized at Mercer University's Chemistry Department. Our goal is identifying compounds capable of inhibiting and/or disrupting biofilm growth through novel mechanisms. We employed growth curves, doubling time analysis, and biofilm assays to evaluate the efficacy of each drug in inhibiting *C. albicans* growth. Our findings revealed that the compounds Tyr-13, Tyr-16, Tyr-40, and Tyr-42 exhibited the potential to inhibit growth and disrupt biofilm formation. The compounds Trp-51, Tyr-51, Tyr-63, and Val-51 exhibited the potential to disrupt biofilm formation without affecting cell growth. The compound Tyr-52 inhibited only growth and not biofilm formation. These results provide a basis for future studies targeting the genes involved in biofilm development in *C. albicans*, potentially paving the way for more effective treatments, especially in cases of drug-resistant biofilm formation.

BBB7 - Novel DNA-based Vaccines for Flaviviruses

Jessica Bryndal, Jorggedyg Castillo-Perez

Northern Kentucky University, Highland Heights, KY

This project focuses on the generation and characterization of novel DNA-based vaccines for human flaviviruses. This virus family includes hepatitis C virus, Dengue virus, Zika virus, and West Nile virus. The vaccines are being tested for their ability to express the viral targets in human cells. The vaccines are also being evaluated for their immunogenicity in human immune cell cultures. Results from these experiments will demonstrate the potential of DNA-based vaccines for stimulating protective immune responses to human flaviviruses.

BBB8 - Modification of Aliphatic Amino Acids with 2-Fluoro-5-nitrobenzoic acid and its Effect on Gram-positive Biofilm Inhibition

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Due to the increasing resistance of bacteria to traditional antibiotics, it is important to pursue alternative methods to treat bacterial infections. Biofilm formation by bacteria has been shown to increase resistance to antibiotics through the formation of a protective layer around the bacteria which can contaminate medical equipment and lead to further medical complications. One possible way to prevent biofilm formation is to interrupt the quorum sensing capabilities of bacteria which allow for biofilm production and virulence factors to arise. There is some evidence that D- aliphatic amino acids have inhibitory effects on biofilm production. Our lab has attempted to increase these inhibitory effects through the addition of a 2-Fluoro-5-nitrobenzoic acid to aliphatic amino acids to create the novel compounds Alanine 55, Leucine 55, Valine 55, and Isoleucine 55 in *Staphylococcus aureus* and *Streptococcus mutans*. These drugs were tested for possible biofilm inhibition initially through a crystal violet assay. After identification of possible inhibitors, a series of secondary assays were conducted including use-dilution, disk-diffusion, and planktonic assays. Preliminary testing has shown Valine 55 decreased biofilm formation of *Streptococcus mutans* by 40% in comparison to the DMSO control ($p = 0.0126$). Disk-diffusion showed that no ring of inhibition when treated with Valine 55 demonstrating a lack of bactericidal effects. Furthermore, use-dilution showed no significant difference between Valine 55 and the DMSO control indicating the drug is not bacteriostatic. Alanine 55, Leucine 55, and Isoleucine 55 still need to be tested to determine the potential role of polarity in these inhibitory effects.

BBB9 - Characterization of Mutants and Mechanistic Insight Into Biofilm Biosynthesis in *Streptococcus mutans*

Priscilla Haywood[1], Rachel Thigpen[1], Sahar Hasim[2]

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Biofilm formation has been implicated in the resistance to antimicrobial agents and pathophysiology of various bacterial pathogens, including *Streptococcus mutans*. This study aimed to identify and characterize *S. mutans* mutants displaying reduced biofilm formation. Strains of *S. mutans* were mutated using Acridine Orange. Congo Red assays were conducted to screen for differences in biofilm biochemical makeup in order to identify potential mutants. Crystal Violet assays were then performed to quantify each strain's biofilm production; three mutants with reduced biofilm production were identified: BG-C2, BG-A1, and B&B#2. Growth curves demonstrate that the mutations present in two of these three lines, BG-A1 and B&B#2, did not significantly affect the bacteria's doubling times relative to wild-type, suggesting the reduction in biofilm is due to a mutation in the biofilm biosynthesis pathway and not an inability to reach quorum. Next, isolated DNA from the selected strains was sent for genomic sequencing. The sequenced mutant genomes were compared to that of wild-type *S. mutans* to identify the mutated genes involved in the biofilm pathway . Identifying genes related to biofilm production in *S. mutans* will enhance the understanding of how this species produces biofilm. Understanding these pathways will facilitate the development of targeted drug therapies to inhibit biofilm production, thus making infections easier to manage and reducing the spread of antibiotic-resistant plasmids.

BBB10 - Comparison of insulin pathway gene Pdk1 between *Drosophila melanogaster* and *Drosophila arizonae*

Caitlin Stanley

Athens State University, Athens, AL

Comparison of insulin pathway gene Pdk1 between *Drosophila melanogaster* and *Drosophila arizonae*

Caitlin Stanley

Athens State University

The PATHWAYS Project is a program designed to discover genetic changes in insulin pathways between different species of the genus Drosophila, or fruit flies. My project focuses on confirming the Pdk1 gene model in *D. arizonae. 3*-Phosphoinositide-dependent kinase 1 (*Pdk1*)is an important gene as it codes for the Pdk1 protein which regulates insulin-mediated growth through phosphorylation of key proteins in the insulin pathway. This research helps to annotate the *D. arizonae* genome and will be used to investigate evolutionary changes across theDrosophila genus. This helps us to understand which genes are the most evolutionarily conserved and which are under linked evolutionary pressures. This will translate to human medical research on diabetes by furthering our understanding of the insulin pathways. I have used multiple different bioinformatic approaches and have discovered that my gene ortholog and its genomic neighborhood are highly conserved between the two species.

BBB11 - The HTLV-1 basic leucine zipper factor alters host cell metabolism

Hunter Sjobom

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Human T-cell Leukemia Virus (HTLV-1) is a human retrovirus that establishes a lifelong infection of host immune cells which may develop into Adult T-cell Leukemia (ATL). The process by which the virus transforms host cells into a cancerous state is not well understood, but the HTLV-1 basic leucine zipper factor (HBZ) protein has been shown to play an important role in carcinogenesis. HBZ is a viral transcriptional regulator that controls the expression of both viral and cellular genes. Numerous studies have shown that HBZ

alters the gene expression of infected host cells in ways that promote carcinogenesis. However, it remains unclear how these genetic changes result in the metabolic reprogramming that is characteristic of cancer. Here, we evaluated the metabolic changes caused by the HBZ protein and whether these changes are reported to be involved in cancer progression. Recently, our lab has obtained preliminary data which suggests that polyamine biosynthesis is upregulated in cells expressing HBZ. Polyamines (including spermine and spermidine) act as positive regulators of the cell cycle and dysregulation of polyamine biosynthesis has been observed in several types of tumors. Further, polyamines have also been implicated in metastasis, which may make them possible therapeutic targets. This project aims to evaluate whether the upregulation in polyamines is due to HBZ-mediated changes in the expression of biosynthetic genes. We hypothesize that HBZ enhances the expression of the polyamine biosynthetic enzymes spermidine synthase (srm) and spermine synthase (sms).

BBB12 - Extraction of Transcriptional Regulators for the Polyhydroxyalkanoate Depolymerase Gene from *Streptomyces nymphaeiformis*

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Plastic waste has become an increasingly prevalent environmental pollutant. This problem is exacerbated by the inability of plastic to degrade under most natural conditions. In contrast, polyhydroxyalkanoates (PHAs) are biologically produced, plastic-like polymers that can be broken down and metabolized by bacteria. The bacterium *Streptomyces nymphaeiformis* can degrade the PHA, polyhydroxybutrate (PHB), using an extracellular PHB depolymerase, which is encoded by the *phaZ* gene. PHB depolymerase is synthesized only in the presence of PHB or its monomer, but not glucose, suggesting that transcription of *phaZ* is regulated, presumably by transcriptional regulatory proteins that bind to its promoter region. The DNA base sequence of *phaZ* has previously been determined. In the predicted promoter region, there are sequences with homology to binding sites for known transcriptional regulators from other bacteria. A modified pull-down assay using streptavidin magnetic beads was evaluated for success in elucidating potential regulatory DNA-binding proteins for the *phaZ* gene. However, the method was unsuccessful.

BBB13 - The Effect of in ovo Nicotine Administration on Tbr2 Expression during Gray Matter Development in the Chicken Embryo

Lila Bagley

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Smoking during pregnancy is known to have negative impacts on adult health and fetal development. Nicotine, one of the harmful chemicals found in cigarettes, has been shown to cause developmental abnormalities in several organs including the brain, however, there is little research on nicotine's effect on gray matter development. The T-box gene, T-brain 2 (Tbr 2) has been shown to be an important regulator during the development of the cerebral cortex in mice and chicken. In our study, fertilized chicken eggs were injected *in ovo* on embryonic day (E) 3 with either 0.67% or 1% nicotine. Tbr2 mRNA expression was observed on E15 of the embryonic chick brain using quantitative RTPCR. The expression of Tbr2 in the treated embryos significantly decreased with increasing concentrations of nicotine compared to the nontreated embryos ($p = 0.001$). There was no significant difference between the two treatment groups. Our results are consistent with a previous study in which gray matter volume in the brains of adult smokers was significantly lower than that of adult nonsmokers.

BBB14 - Effects of UV Radiation on MCF-7 Breast Cancer Cells

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Epithelial cells play a key role in protecting our body from hazardous environmental factors. The most detrimental threat to our cells is the sun because excessive sun exposure can lead to numerous pathologies, as well as sunburn and premature aging. The sun exposes our cells to harmful UV rays, including UVA and UVB rays. Since our skin is our body's first line of defense, epithelial cells are the primary cells affected by sun exposure. This prompted our research to question what is happening on the molecular and genetic level to our cells after exposure to UVA, UVB, and UVC rays. For this project, we are using MCF-7 breast cancer cells cultured under standard, sterile conditions. Our preliminary studies exposed MCF-7 cells to UVC radiation in different time increments (10 seconds up to 2 minutes) to identify non-lethal UVC exposure that will be the focus of our future studies. It is already well-known that UVC exposure is lethal to cells, but we are interested in determining the molecular effects of low exposure that does not induce a significant decrease in viability. After UVC exposure, we incubated cells for 24 hours to allow for DNA damage responses. Then, we used a Resazurin assay to measure the effect of UVC exposure on MCF-7 cell viability, and a Comet assay to quantify the extent of DNA damage caused by exposure to UVC. These techniques, along with RT-PCR and Western blotting, allow us to observe changes to DNA damage and oxidative stress response pathways. We plan to expand our study to also compare the effects of UVA and UVB exposure. Our results can ultimately help improve our understanding of DNA damage and oxidative stress caused by UV radiation.

BBB16 - Examining the role of BRK1 in the embryonic development of Zebrafish (Danio rerio)

Max Williams

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The gene Brk1 codes for a protein that is a known subunit of the Scar/Wave complex. This complex is responsible for the process of actin nucleation, which is needed for elongating actin filaments, the major structural component involved in many processes that induce cell morphogenesis (e.g. lamellipodia formation, dendrite formation, cytokinesis). Brk1 is thought to be a precursor of the Scar/Wave complex, and can stably exist alone out of complex, unlike other Scar/Wave proteins. This study explores the role of this subunit protein in the embryonic development of zebrafish. To this end, we started by determining *BRK1* gene expression across different zebrafish tissues. *BRK1* expression was seen highest in the liver and gall bladder, followed by the ovary and brain. Ubiquitous expression of SRK Family Kinases SRC and LYN were observed across all tissues tested. Future experiments will look at *BRK1* expression during the different stages of embryo development. Experiments wherein zebrafish embryos are microinjected with *BRK1* morpholino oligonucleotides to knock down the expression of BRK1 are ongoing. Validation of *BRK1* morpholino was determined using *BRK1* RNA expression. The variance of expression and morphology between the embryo treatment groups is expected to intimate possible developmental processes in which the Brk1 protein is involved, and its role within those processes.

This research was supported by a Beta Beta Beta Research Grant.

BBB17 - Confirming the gene model of Insulin-like peptide 1 *(Ilp1)* in *D.* rhopaloa by comparing it to its homolog in D. melanogaster

Brooke Stanley

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The current focus of the Pathways Project is to better understand the genes in the insulin-signaling pathway across the fly genus, Drosophila. We confirmed the gene model of Insulin-like Peptide 1 (Ilp1) in D. rhopaloa, a diurnal species of fly in the family of vinegar flies, by comparing it to the homologous gene in D. melanogaster. *Ilp1* is part of the insulin-signaling pathway, an insulin-receptor ligand. The protein is found in the extracellular space and is expressed in several structures, including embryonic/larval brains, the insulin-secreting cell of pars intercerebralis, and pars intercerebralis primordium. This research was part of the larger Genomic Education Partnership, which uses publicly available databases of fly genomes and RNA expression to study the evolution of Ilp1 as it relates to the insulin-signaling pathway.

BBB18 - The Effect of Long-term Intermittent Fasting on Spatial Memory in Rats

Jordyn Deason

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Cognitive decline in the aging population is a crucial health care issue which continues to progress at an accelerated rate. Intermittent fasting has been found to mitigate cognitive decline and enhance the brain's ability to resist effects of aging. In this study, we examined the effects of intermittent fasting on the spatial memory of aging rats. Twelve age-paired rats were divided into two groups. Fasted rats and rats fed ad libitum (ad lib) were subject to multiple trials of a Morris Water Maze (MWM) to assess their spatial memory at different ages. The group of fasted rats were exposed to intermittent fasting regularly for approximately two years. The standard protocol involved a 24-hour fast twice a week and followed by ad lib feeding the other five days of the week. Comparing the performance of the two groups of rats in the MWM provided insight into whether intermittent fasting helps prevent decline in spatial memory of aging rats. Fasted rats performed significantly better during the MWM trials. In conclusion, intermittent fasting may be a meaningful and affordable practice that elderly people could practice regularly to delay the effects of age-related cognitive decline.

BBB19 - *Momordica charantia:* Testing for Antibiotic Properties

Donna Tran

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Natural products derived from plants have proven to be a source of many biologically active components, many of which are the basis of many medicines today. With the emergence of antibiotic resistance, scientists have turned to traditional medicine from other cultures that have used plants historically. Extracts that are isolated from medicinal plants have been seen to have many biological activities, such as antimicrobial, anti-inflammatory, and antioxidant activities. *Momordica charantia*, better known as bitter melon, is a popular vegetable used in Cambodian and Vietnamese cuisine due to its many health benefits. These benefits include reducing blood sugar, having cancer-fighting properties, decreasing cholesterol levels, and more. With *Momordica charantia*'s many benefits to humans, there may be more when looking microscopically. The fruits and leaves of the *Momordica* species are rich in phytochemicals, which are chemicals found in plants to protect them against bacteria, viruses, and fungi. Although traditional medicinal practices have involved mainly ingesting the *Momordica charantia* plant, the question arises as to whether it contains any potential antibiotic properties that would aid in the fight against antibiotic resistance. The results of research conducted on extracts from the leaf, stem, seed, and fruit of the *Momordica charantia* plant to four types of bacteria: *Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli,* and *Bacillus subtilis* will be presented.

BBB20 - Combating Antibiotic Resistance: Antibiotic Properties of Lavender and Thyme

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Antibiotic resistance represents a significant crisis in public health, killing millions of people annually. Antibiotics, which revolutionized modern medicine, treating bacterial infections that were once considered fatal, are now less effective since bacteria has evolved and become resistant to these compounds. Historically, we have not always utilized antibiotics, using things like herbs and plants to treat infections and diseases. In the search for new sources of antibiotic compounds, scientists have turned to historical records and traditional practices to identify potential candidates. *Lavandula angustifolia (*lavender) and *Thymus vulgaris* (thyme), have previously been shown to have antibiotic properties against bacteria as well as many other benefits such as being anti-inflammatory, antioxidant, anxiolytic, and antinociceptive properties. In this study, I compared the antibiotic properties of both lavender and thyme separately and together against two common bacteria, *Escherichia coli* and *Bacillus subtilis.* Steam distillation was used to extract the essential oil from each plant. Commercially available forms of the extracts were used for comparison. These oils were tested against the gram positive and gram negative bacteria using the Kirby-Baurer method and minimum inhibitory concentration (MIC) assay. The results of these assays will be reported.

BBB21 - Utilizing Reverse Genetics to Explore SMAX1-Dependent Seed Germination in Arabidopsis

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Germination, one of the most regulated events in a plant's life, is the process by which a seed will sprout and begin forming a seedling. In Arabidopsis, SMAX1 is one of two pathways that can be taken to achieve seed germination, in addition to the Gibberellic acid pathway. SMAX 1, a suppressor of MAX2, is an important part of the karrikin signaling pathway. Karrikin is an abiotic compound that is found in smoke, and known to trigger seed germination. After reviewing an extensive list of genes that may be involved in this seed germination pathway, we identified specific candidates for further evaluation using CRISPR mutants. We have begun looking closely at select genes that are instrumental in generating responses to environmental stimulation. Additionally, we are using a CRISPR based approach to evaluate these genes.

BBB22 - **Antibiotic Properties of Cedarwood Oil**

Mia Hoffman

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More than 2.8 million antimicrobial-resistant infections occur each year in the United States. Antimicrobial resistance is an urgent public health issue witnessed globally and we need to do what we can to prevent new resistance from developing and to stop the spread of resistance that already exists. Many plant materials such as cedarwood oil, have shown to have anti-inflammatory and antimicrobial properties. One study in particular found that *Escherichia coli, Bacillus subtilis* and *Bacillus cereus* were sensitive to cedarwood oil and showed bactericidal activity. In the current study we compared the effectiveness of steam distilled or commercially produced oil. The oil from needles and wood of a cedarwood tree where isolated by steam distillation. Antibiotic properties of the compounds were assessed Minimum inhibitory concentration (MIC) assay and Kirby Bauer Assay.

BBB23 - Biofilm Inhibition & Eradication with Novel Biofilm-Inhibiting Small Organic Molecules and Bacteriophage Combinations.

Madison Courts, Janki Patel, Dhruv Patel

Roanoke College, Salem, VA

Biofilm is an extracellular matrix that bacteria produce once a certain density is reached. Biofilm production is a virulence factor for many species of bacteria. For example, *Streptococcus mutans* biofilm is associated with dental caries. Research to both inhibit and eradicate biofilm production in medically relevant bacteria has been abundant in the last decade. Most of the work entails novel small molecules as inhibitors while we hypothesize that naturally occurring bacteriophage may be more successful in penetrating the biofilm matrices and work in conjunction with these small molecules to eradicate/inhibit biofilm. We tested five bacterial species: *B. subtilis, E. coli, Pseudomonas aeruginosa, Staphylococcus aureus,* and *Streptomyces mutans* each with their own novel inhibitor and bacteriophage. We isolated species-specific bacteriophage from antiseptic mixtures from the Iliava Institute in Tbilisi, Republic of Georgia for 4 of these 5 species. For *B. subtilis*, we isolated a bacteriophage using HHMI Seaphage protocols. We measured biofilm production with a modified Crystal Violet Assay. Our initial results led us to further study *E. coli* and *Staphylococcus* aureus because those results were the most consistent. Both the novel inhibitor and the bacteriophage inhibit biofilm production in *E coli.* However, when used together, there is no additional inhibition. For *Staphylococcus aureus*, we used a biofilm accelerator and found that bacteriophage addition after 12 hours of biofilm growth resulted in eradication of the biofilm, even in the presence of the accelerator. Our future endeavors include fully characterizing the specific bacteriophages by DNA sequencing and using this assay to test additional novel lead compounds and additional bacteriophages.

BBB24 - Mediterranean versus Western diet and the Gut-Brain Axis: Diet-induced links between gut microbial abundances and heart rate variability in Captive Female Cynomolgus Macaques (*Macaca fascicularis*).

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Heart rate variability (HRV) - the variation in time between heartbeats - reflects the activity of the autonomic nervous system and is often used as a metric of sympathetic versus parasympathetic activation. Dietary patterns have been shown to impact HRV, with unhealthy diets promoting sympathetic activation and healthy diets promoting greater parasympathetic activation. The composition of the gut microbiome may mediate the relationships between dietary patterns and the autonomic nervous system. To study the relationships between diet, gut microbiome, and HRV, we conducted a preclinical, randomized dietary intervention in a nonhuman primate model: cynomolgus macaques (Macaca fascicularis). We found several significant differences in the composition of the gut microbiome across diets: an abundance of Lactobacillus (t=1.789; p=0.029), Oscillospira (t=2.904; p=0.008), and Faecalibacterium (t=3.86; p=0.001). We also detected several significant correlations between the gut microbiome and HRV parameters. Finally, we determined a positive relationship between Oscillospira and the LF/HF ratio (p=0.00025). These results suggest that dietary patterns can lead to alterations in gut-microbiome composition. They also suggest that the microbiome may mediate the relationship between diet and the autonomic nervous system. Ultimately, this study provides important insight into the importance of diet and how it can affect multiple systems in the body in ways relevant to health.

BBB25 - Investigating how a mutation in Fus1 alters protein interactions during cell fusion

Briana Robinson

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Cell fusion is an essential eukaryotic process that occurs during mammalian development, including fertilization and muscle development. Despite the importance, the molecular mechanisms of fusion processes are still under active investigation. *Saccharomyces cerevisiae*, or budding yeast, provides an excellent model to study fusion, as these eukaryotic cells fuse during mating. Fusion begins when cells of the opposite mating type polarize their growth towards each other, creating a flat interface between the cells where fusion occurs. At this step, the cell walls between the mating pair must degrade before plasma membrane fusion and cytoplasmic mixing can occur. This step involves many key proteins that interact with each other to ensure successful cell wall degradation. Fus1 is a transmembrane protein hypothesized to act as a scaffold to bring other fusion regulators to the zone of cell fusion. However, its specific protein-protein interactions and function have not been uncovered. Fus1 contains a cytoplasmic, C-terminal SH3 domain, a highly conserved domain found in other proteins where it facilitates protein-protein interactions. To determine the function of this domain in Fus1, we analyzed a point mutation where a conserved histidine residue was mutated to alanine, H469A. Through microscopy-based assays, we found that this mutation causes a significant decrease in fusion. The Fus1-H469A protein has a decrease in localization to the fusion zone. We hypothesized that these phenotypes resulted from a block in protein-protein interactions, and investigated the genetic interaction between Fus1 and Fus2, another fusion regulator that localizes to the fusion zone. We found a decrease in co-localization of Fus2 and Fus1-H469A compared to the wildtype proteins and determined that the deletion of *FUS2* had a smaller effect on Fus1-H469A than wildtype. We propose that the H469A mutation alters Fus1's ability to interact with Fus2, meaning the SH3 domain serves a key role for fusion.

BBB26 - Involvement of the NF-kappaB and CXCL10 Signaling Pathways in Triple Negative Breast Cancer Invasion

Sonia Jose

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Triple-negative breast cancer (TNBC) is a very aggressive subtype of breast cancer commonly seen in younger and minority women. Tumor-associated macrophages (TAMs) can compose up to 50% of the TNBC tumor microenvironment and play a significant role in tumor growth and metastatic ability. This study aimed to understand how the nuclear factor-kappaB (NF-κB) signaling pathway in TAMs advances TNBC tumor development and metastasis by influencing tumor-promoting cytokines and invasive ability. We hypothesized that the inactivation of the canonical NF-κB pathway would lead to fewer cancer-promoting cytokines and reduce TNBC cell invasion. By utilizing bone marrow derived macrophages (BMDMs) that lack the p65 transcription factor of the NF-κB pathway, we could study the effect of inactivating the NF-κB pathway in TAMs associated with TNBC. In this study, p65 knockout and control BMDMs were co-cultured with TNBC cells for 48 hours. After which, the TNBC cells were used for an invasion assay and the culture media was subjected to cytokine analysis. The cytokine array revealed a higher expression of some cytokines, including IL-6, ICAM-1, TNFα, and TIMP-1 in control BMDMs as compared to p65 knockout macrophage cultures. An invasion assay was used to quantify the amount of invaded TNBCs after a 24-hour culture in various conditions. Based on the invasion assay, we concluded that there is a significant decrease in TNBC invasion when the cells are co-cultured with p65 knockout macrophages. Cell invasion decreased when TNBC cells were co-cultured with BMDMs, as compared to solo cultured TNBCs cells. In addition, cell invasion increased with the presence of pro-tumor cytokines released by BMDMs. This study has allowed us to better understand the role of macrophage NF-κB influence on aggressive TNBC properties.

BBB27 - Isolating and Sequencing soil bacteria displaying zones of inhibition.

David McCaulley

Athens State University, Athens, AL

The Earth's soil serves as a reservoir of water and nutrients, as a medium for filtration and breakdown of wastes, and as a participant in cycling carbon and other elements through our ecosystem. Bacteria play a major role in soil health. One teaspoon of healthy soil can contain up to a billion bacteria, some of which present inhibitory properties used to create antibiotics. Antibiotics are one of the most important commercially exploited secondary metabolites produced by bacteria and many of the antibiotics used today were discovered from microbes. I investigated microbial interaction in soil samples from two locations,collected in the mountains of Hayden, Alabama. The question for this research is, what kind of bacteria are present in mountain soil, and do they have any antibiotic capabilities? Soil was collected from one area under two different conditions: direct sunlight and a shaded region with minimal sunlight. After plating,

colonies with a clear zone of inhibition were isolated and sequenced *Bacillus cereus* and *Rhodococcus qingshengi* were among the colonies isolated.

BBB28 - The Molecular Mysteries of *C. elegans*: Total Protein Isolation Techniques

Andrew Jimenez

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C. elegans, better known as a roundworm nematode, is a popular model organism used in studying neurological disorders like dementia. Our research focuses on a specific protein, APL-1, which is an ortholog similar to human amyloid precursor protein that is linked to early onset Alzheimer's disease. The ynIs-79 nematode strain is an overexpression mutant in which accumulation of the protein causes larval lethality, molting defects, and motor dysfunction. This mutant overexpresses APL-1 in ventral cord neurons and is tagged with a GFP marker. Thus far, we are using traditional, ultrasonic bath, and homogenization protein extraction techniques to determine the baseline concentrations of total protein in various *C. elegans* strains. These techniques will serve to maximize total protein concentration to quantify APL-1 using Western Blot analysis. The traditional protein extraction yields low total protein and reduces the chances of identifying APL-1, while the ultrasonic bath extraction technique yields higher total protein. In summary, optimizing protein isolation will allow us to accurately quantify the APL-1 protein at specific stages of the nematode's life cycle when raised in the presence of various antioxidant compounds.

BBB29 - Effect of Allicin on Proliferation and Viability of Human T-Cell Lymphocytes

Siri Ugru

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T-cell lymphocytes are a type of white blood cell which develop from the bone marrow and serve as an essential part of the immune system. When these cells become cancerous and begin to proliferate uncontrollably, the production of healthy immune cells becomes disrupted, and the immune system becomes gradually weaker as the disease progresses. Cancer of the T-cells is often treated using chemotherapy, a treatment which targets and kills cancerous cells. However, chemotherapy has been found to have lasting negative effects on the immune system because it often kills healthy white blood cells along with target cancer cells. This is especially detrimental for people who have lymphatic system cancer, as they already possess fewer healthy lymphocytes. For this reason, natural treatments are being researched to be used in combination with chemotherapy, with experimental evidence suggesting that certain natural compounds used in combination with chemotherapy can reduce multidrug resistance and serve as a chemoprotective agent. One such possible adjuvant treatment is allicin, a compound found naturally in freshly crushed garlic which displays antimicrobial and antibacterial properties. The research aims to expand on past work done on allicin's anticancer properties by testing its effect on the Jurkat cell line of human T-cell lymphocytes. The experiment will use a trypan blue exclusion assay in order to compare cell viability in cultured cells treated with varying concentrations of allicin. It is hypothesized that lymphocytes treated with no allicin or a small concentration of allicin will have more ability to proliferate freely, while cells treated with high concentrations of allicin will undergo apoptosis due to its antimicrobial effects. The results of this research may provide insight into allicin and its potential as an adjuvant therapy.

BBB30 - Identification of Soil Microbiota Strains with Poly-3-hydoxybutyrate (PHB)-Degrading Capabilities

Christina Masika

Catawba College, Salisbury, NC

The continual pollution of our environment with polymer plastic derivatives has made it increasingly important to find contemporary approaches for plastic and microplastic decontamination. Recent novel investigations have identified microbial partners in our environment capable of degrading a variety of plastic polymers, such as polyethylene, polyester and poly-3-hydroxybutyrate (PHB). We therefore sought to survey microbial communities from our Catawba College campus to determine if resident microbiota may possess enzymes capable of degrading PHB. Samples were collected, and diluted if needed, before being inoculated onto PHB-infused Nutrient agar plates according to procedures set forth by Egusa et. al. (2018). Several PHB-degrading strains were isolated, axenically cultured and analyzed for enzymatic activity, followed by genotyping analysis using 16S barcoding. Nine species were genetically identified that showed PHB degradation, with rates that ranged from 0.0006 – 0.0150 mg/ml/min. Of the 9 species, 5 have been reported to demonstrate PHB degradation, while 4 of the 9 are novel. Future work will look at the potential synergistic effect of PHB-degraders in mixed cultures. The enzymatic breakdown of PHB presents an opportunity to explore this concept of biologically degraded plastics as a solution to the disastrous global plastic waste problem.

BBB31 - An Analysis of Antibiotic Resistance Levels of *Enterobacteriaceae* Found in Manure of Cattle Populations Along the Holston Watershed

Jordan Leatherman

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Antibiotic resistance in microorganisms is one of the greatest threats to public health and is being exacerbated by excessive and improper antibiotic use. Livestock, including poultry, swine, and cattle, which are extensively treated with antibiotics, foster antibiotic-resistant gut microbiota, leading to contamination of nearby bodies of water through their feces. An analysis of the South Holston Watershed using satellite imagery revealed nearby water treatment plants, hospitals, and industrial agriculture systems. During the summer of 2022,

water samples from Shook Branch and Watauga River tested positive for presence of fecal coliform bacteria. Cattle manure samples were collected from four farms upstream of Shoork Branch and Watauga River swimming locations. This study aims to investigate the relationship between antibiotic resistance of bacteria in cattle manure of upstream farms and bacteria in contaminated downstream water locations. We hypothesized that there are similar degrees of antibiotic resistance found in bacterial isolates from recreational water sites and cattle manure of upstream farms. Test results indicate the presence of Escherichia coli, Salmonella spp., Klebsiella spp., Citrobacter spp., Shigella spp.,Serratia spp., and Enterobacter spp. Antibiotic susceptibility testing revealed that 100% of isolates were resistant to at least 1 antibiotic, 99.4% were resistant to at least 2, 91.7% were resistant to at least 3, 78.3% were resistant to at least 4, and 51.2% were resistant to at least 5. 100% of isolates were resistant to bacitracin and 97.4% were resistant to penicillin. The prevalence of antibiotic resistance in cattle populations along the South Holston Watershed raises concerns. These resistant bacteria could potentially enter water sites through runoff and leaching, posing risks to public health. Research will continue evaluating resistance levels in bacterial isolates from these cattle in comparison to resistance levels of bacterial isolates found in adjacent recreational water sites.

BBB32 - Effect of the Insecticide, Fipronil, on Oviposition Choice for Female *Culex* Mosquitoes

Abilene Morgan

Northern Kentucky University, Highland Heights, KY

Culex mosquitoes are the primary vectors of diseases that affect humans and other animals, including West Nile virus. Two semi-controlled field assays were conducted to determine if the insecticide Fipronil has an effect on oviposition (egg-laying) choice of female *Culex* mosquitoes. The first field assay examined how differences in concentration impact oviposition choice. For the first assay, the concertation of Fipronil was varied (control with no Fipronil, low dose of 25 mL of Fipronil, high dose of 50 mL of Fipronil) across the three at five sites. For the second assay, the timing of Fipronil addition was differed (control with no Fipronil, 50mL of Fipronil added once, 50mL of Fipronil added biweekly) at five additional sites. For ten weeks, egg rafts are collected daily and identified to species. The results show that female *Culex* mosquitoes significantly prefer to oviposit in containers with higher concentrations of Fipronil and in containers with continual addition of Fipronil. The results of this study suggest that Fipronil can be used to control mosquito populations at the larval stage. Future studies are planned to determine the lethal dosage of insecticide required for both larval and adult *Culex* mosquitoes.

BBB33 - Monarch Butterfly Feeding Preferences on Kentucky Wildflowers

Trey Zinsmeister

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Monarch butterflies (*Danaus plexippus*) are an endangered, nectar-feeding butterfly that migrates to Kentucky during the summer remaining from of June through August. Many factors have contributed to the decline of Monarchs including habitat loss and pesticide use which have also effected many of our native wildflowers. A choice experiment with butterfly milkweed (*Asclepias tuberosa*), tall garden phlox (*Phlox paniculata*), and blanket flower (*Gaillardia aristata*) was performed in greenhouses to determine if Monarchs have a feeding preference on different Kentucky wildflowers. Adult Monarch butterflies were monitored daily to determine which flowers the Monarchs fed on. The results show that Monarchs fed on three native wildflowers in the absence of other food sources. When all three wildflower species were housed together, the blanket flower was fed on the least while the butterfly milkweed was feed on the most. The results of this project will be used to inform gardeners on which native plants should be planted in their gardens to attract Monarchs and other pollinators supporting the native plants, as well as providing habitat for Monarchs, other pollinators and birds.

BBB34 - Evaluating the Effectiveness of Ovillanta Traps for Mosquito Control in Temperate Ecosystems

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Discarded tires are a good environment for female mosquitoes to lay their eggs and for the resulting larvae to develop. Tires are able to hold sufficient amounts of nutrient-rich water and shelter the developing larvae from harm until they pupate and emerge as adults. The best way to control mosquito-borne diseases is through controlling the mosquitoes themselves. The goal of this experiment was to determine if ovillanta traps, a mosquito trap created from used tires, can be implemented for mosquito control. Ovillanta traps were created by cutting tires into quarters and placing one quarter into another making a tire-like, covered habitat. One ovillanta trap and one normal, intact tire were placed at five sites in Boone County, KY. Mosquito larvae and pupae were collected from the tires weekly for twelve weeks and identified to species. A total of 9,786 mosquitoes from 10 different species were collected from all sites with 5,809 mosquitoes collected from the ovillanta traps and 3,977 were collected from natural tires. The effectiveness of these traps suggests that the ovillanta traps can be used to control mosquito populations in temperate ecosystems. Future studies will examine if citizens are able to properly use these ovillanta traps for mosquito control in residential yards.

BBB35 - Seasonal Tick Species Distribution within the Northern Kentucky Region

Aminata Harouna

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Ticks are vectors of diseases that can infect humans and other animals, and different species of ticks transmit different diseases. The northern Kentucky region is within a zone of tick expansion with blacklegged ticks, *Ixodes scapularis*, moving from the north and the Lone Star ticks, *Amblyomma americanum*, moving from the south. This study aims to examine the distribution and seasonality of tick

species zone of tick expansion. Starting in June 2022, tick collection occurred weekly across an anthropogenic, land-use gradient at ten sites. A drag cloth was pulled over each 500-meter transect and was checked every 10 meters for ticks. All ticks were collected and identified to species in the laboratory. One hundred nine American dog ticks (*Dermacentor variabilis*), 91 blacklegged ticks (*Ix. scapularis*), and 2 Lone Star ticks (*Am. americanum*), have been collected for a total of 202 ticks. American dog ticks were most commonly collected in summer months peaking in June and July whereas blacklegged ticks were most collected between October and April, peaking in November. Sampling is ongoing and will continue through August 2024. Understanding tick species distribution and seasonality in the region allows for effective control strategies to reduce ticks and tick-borne diseases.

BBB36 - Does repeated sampling by students harm the macroinvertebrate community of a headwater stream?

Margaret Bennett

Dalton State College, Dalton, GA

Macroinvertebrates are critical members of aquatic communities and play an integral role in the food webs of these ecosystems, as well as being effective bioindicators of pollution and other environmental risks. Sections of Dalton State's College Creek have been repeatedly sampled by student groups for nearly 30 years. It was hypothesized that these disturbances may negatively affect the macroinvertebrate populations in these areas. We determined the impact of student disturbances by collecting samples of macroinvertebrates from multiple sites in the stream using a Surber sampler, and then counting and identifying the macroinvertebrates found. Monthly sampling was conducted from January through April of 2023. Sampling occurred in both a site frequently disturbed by student sampling as well as an undisturbed reference site further upstream. Water quality measurements were also taken from both sites on each sampling date. No statistical differences were found between the experimental and control sites for the macroinvertebrate community metrics. There were also no significant statistical differences in water quality except for conductivity, with it being significantly higher in the control site. The reason for this conductivity difference is currently unknown. With these results we can conclude that the repeated macroinvertebrate sampling by students has not had any significant effects on the macroinvertebrate community in College Creek.

BBB37 - A Survey of the *Cantharellus* Species in Western Virginia

Melanie Pick

Bridgewater College, Bridgewater, VA

Chanterelle mushrooms (*Cantharellus* spp.) are among the most popular wild edible mushrooms worldwide, with *C. cibarius* being the most well-known. Efforts to understand chanterelle diversity, however, have been somewhat limited by issues with the standardly used nuclear ribosomal internal transcribed spacer (*ITS*) fungal DNA barcode. Although considered the universal barcode for fungal species, *ITS* is problematic for *Cantharellus* identification due to high levels of diversity and length variation, particularly in the ITS1 region. Alternative markers, including *RPB2* and *tef1-α* have been identified and utilized as supplemental markers for the analysis of *Cantharellus* species. Recent studies using these regions have shown that *C. cibarius s.s.* is a European species and that the North American collections of this complex represent many cryptic species. This study explores collections of the *C. "cibarius"* complex from the Shenandoah Valley to determine what species are represented in western Virginia and what, if any, genetic variation might be present. At least five species were identified in a small area northern Augusta Co., VA.

BBB38 - Assessment of Small Mammal Community Structure Based on Analysis of Owl Pellets: A Comparison of Pacific Northwestern and Southeastern U.S. Barn Owls (*Tyto alba*)

Rachel Ritter, George Argyros

Emory and Henry College, Emory, VA

A total of 258 barn owl pellets (*Tyto alba*) were dissected and analyzed to assess small mammal community structure from two communities of barn owls, one from the Pacific Northwest (Oregon), and the other from the Southeastern United States (Tennessee). Specimens recovered from each pellet were identified to species utilizing dichotomous keys to the small mammal faunas for each region based on cranial and mandibular anatomy and tooth structure. The total minimum number of individuals (MNI) of each species was determined and used to calculate the relative abundance (RA) for each species within each small mammal community. Shannon's Diversity Index, Alpha and Beta diversity for each community were also determined. The southeastern U.S. community totaled 835 individuals representing 16 species from 163 pellets; the community from the Pacific Northwest totaled 291 individuals representing seven species from 95 pellets. The most abundant prey species in both communities were voles of the genus *Microtus*. The eastern community had a higher Shannon's Diversity Index of 1.205, while the northwest Pacific community had a 1.030 diversity index. Results from this study aligned with previous small mammal diversity studies based on owl pellet analysis, indicating that although species composition varies geographically, hunting behavior and habitats frequented by *Tyto alba* are remarkably similar.

BBB39 - Species richness of moths in public parks surrounded by urban, suburban, and rural environments in the vicinity of Nashville, Tennessee

Allie Bennett

Belmont University, Nashville, TN

Moths can act as indicators of environmental wellness due to their sensitivity to pollution and the level of biodiversity required to support their life cycles. Urbanization can reduce environmental wellness and thus impact the occurrence of moths in protected green

spaces. Higher moth species richness was hypothesized to occur in parks surrounded by more rural areas. Three metropolitan parks that are surrounded by varying levels of urbanization were chosen in the Nashville area: downtown, within a suburban neighborhood, and in a rural area. Tree canopy cover and degree of impervious surfaces were assessed for each park and its surrounding area using iTreeCanopy. For three nights at each location, moths were attracted to a white sheet using a mercury vapor bulb, UV wand, and sugar mix. Moths were caught, photographed and/or identified to species, and then released. Results indicated higher moth species richness in the park surrounded by a rural landscape and the lowest species richness in the park surrounded by an urban landscape – supporting the hypothesis. Enhancing moth diversity in urban areas may include monitoring for pollution and installing a biodiverse mix of plant species in areas surrounding public green spaces.

BBB40 - Contrasting effects of early restoration practices and season on soil enzyme activity and nitrogen dynamics

Lauren Young

Roanoke College, Salem, VA

Restoration is important to increase ecosystem services including biodiversity, carbon sequestration, nutrient cycling, and decomposition. Also, soil health is directly impacted by restoration through increased nutrients and organic matter that can alter the amount of soil enzymes and microbial biomass. At Roanoke College's Environment Center, a native meadow is being restored from a landfill site. In June and October, soil enzyme activity, ammonium, and microbial biomass were measured across 18 plots, with various carbon amendments among the meadow. It was predicted that (1) activity for all enzymes as well as microbial nitrogen and phosphorus demand would be greater in summer than fall, (2) ammonium would be greater in fall than spring, and (3) there would be no difference among the different plots due to the recency of the restoration practices.

As expected, enzyme activity and enzyme stoichiometry were not influenced by restoration practices due to the recency of the restoration. Using enzyme stoichiometry, nitrogen was in greater demand than carbon or phosphorus during both sample dates. However, nitrogen demand was slightly reduced relative to phosphorus demand in the fall. The demand for nitrogen was still greatest at all times, but we do see a trend towards increasing phosphorus limitation as we move towards winter. Ammonium on the other hand had a strong response to both restoration practices and sample date. Ammonium values were lowest in the summer and in cropped areas, likely due to competition between plants and microbes. Early restoration practices do appear to influence ammonium dynamics while the microbial community may take more time to adjust.

BBB41 - An Investigation on Zn tolerance in a Phyllite Population of a Rare Plant Species, *Pediomelum piedmontanum* (Fabaceae)

Gabsu Smallwood

Augusta University, Augusta, GA

Pediomelum piedmontanum (Fabaceae) "Dixie Mt. Breadroot" is a rare and endangered plant species with only three known populations, one on serpentine in Georgia and two on phyllite in South Carolina. Serpentine soils typically have high concentrations of metals, such as Ni, Mg, and Zn, whereas phyllite soils may have elevated Mg concentrations, but do not generally have high concentrations of other heavy metals. Previous experiments have shown that the serpentine population can tolerate up to 50 μM $NiSO_4$ and 50 μM $ZnSO_4$. Both phyllite and serpentine populations have atypical Mg requirements with tolerance up to 100 μM $MgSO_4$. Based on its atypical tolerance to Mg, we hypothesized that the phyllite population may also be Zn tolerant due to pre-adaptations to other metals. In order to determine the extent of Zn tolerance, seedlings were treated weekly with 50 μM $ZnSO_4$ solution or deionized water as a control. Each control/experimental group consisted of 20 seedlings /10 replicates 15 cm pots with potting soil, grown in a 1200 watt full-spectrum growth room. Seedlings did not grow or survive as well as plants in the control pots. The results indicate that the Mg tolerant phyllite population does not have elevated tolerance to Zn, unlike the serpentine population of *P. piedmontanum.*

BBB42 - Measuring potential effects of heterotrophs on diel cell cycling of toxic *Microcystis*

Jordan Maddox

James Madison University, HARRISONBURG, VA

Harmful algal blooms (HABs) are found all over the world and have been increasing in frequency during the last decade. These blooms negatively affect the environment by producing toxins that kill flora and fauna, and affect respiratory and liver function in humans. Mitigating HABs requires a detailed understanding of all the factors contributing to bloom formation and persistence. While abiotic drivers, such as temperature and nutrients, have been well studied, less is known about the role heterotrophic bacteria may play in HAB bloom ecology. This study investigates the role of heterotrophic bacteria on the growth, toxicity, and carbon production/secretion of the cyanobacteria *Microcystis*, a particularly pernicious HAB-forming organism. Nine liters of retention pond water containing a *Microcystis*-dominated natural community will be set-up and spiked with two different bacteria that have suggested growth-promoting effects on *Microcystis*. The incubations will be monitored for at least two weeks via cell counts and chlorophyll fluorescence. Samples for RNA-seq will be collected at the 12 and 24 hour time points and then sent to Azenta for sequencing and analysis. Results are expected to reveal new information about how *Microcystis* may be storing carbon over a 24 hour period as well the underlying mechanisms governing the *Microcystis*-bacteria interactions.

BBB43 - Weevil Infestation of Oak Acorns Varies Among Sites during Drought

Virginia Riggar, Bekah Jackson, Seth Hilllis, Emma Thompson

Samford University, Birmingham, AL

Oak trees in Alabama have been having difficulties in reproducing in recent years, and one reason for this difficulty is weevil infestation. Weevils are insects that lay their larvae in acorns, and as the larvae develop, they eat the cotyledon and sometimes the embryo of the acorn. This predation reduces acorn germination and seedling growth and survival. Acorn production and weevil infestation often cycle in a coordinated fashion across regions, but these cycles may be disrupted by events such as drought. We tested the hypothesis that acorn infestation by weevils would vary among sites within the Birmingham Alabama area during a period of drought. The study lasted for a six-week period at 6 different sites in Birmingham, and acorns were collected from a total of 232 trees. We found that no sites were statistically significantly different from each other except for Moss Rock and Oak Mountain where we found that Oak Mountain had lower rates of weevil infestation than Moss Rock. Drought conditions during this study could have affected acorn production, and we noted many acorns dropped while still immature. Weevils inhabiting acorns that do not reach maturity may be smaller or may not complete larval development, lowering the measured rate of weevil emergence from acorns. Moss Rock's environment is more stressful than most other sites due to its shallow, rocky soil which could impact tree and weevil susceptibility to drought. While many studies suggest that weevil infestation cycles across regions, this study explicitly examines the role of environmental stress in inter-site variation in weevil infestation and acorn production.

BBB44 - Human infrastructure decreases predator activity, releasing herbivores from a landscape of fear

Kaitlyn Thompson

Lander University, Greenwood, SC

Human predators affect all animals, but their presence disproportionately harms large predators relative to other trophic levels. In areas with abundant human infrastructure, the density of large predators may be reduced, which could potentially free lower trophic levels from a landscape of fear, allowing them to be more active. Conversely, large predators may change the behavior of lower trophic levels, causing them to be less active in stations where predation risk is high. We hypothesized that in areas with high human infrastructure, large predator activity would decrease while the activity of mesopredators and herbivores would increase. To test these hypotheses, we used our network of 21 camera stations in three counties across South Carolina. The images from the camera traps were collected several times throughout the year and tagged with species and number of individuals present. We calculated the activity level of each trophic level at each station, the intensity of use, by dividing the number of observations of each trophic level by the number of days the camera was active. After this, we used GIS to calculate a human infrastructure score for each camera station based on the density of roads and buildings around the station. To determine whether human infrastructure changes the relationship between trophic levels, we compared the intensity of use for each trophic level between stations with high human infrastructure and stations with low human infrastructure. As hypothesized, the intensity of use by large predators was greater at low-infrastructure stations compared to high-infrastructure stations, and herbivores used high-infrastructure stations more than low-infrastructure stations. In contrast, mesopredators showed no difference between the intensity of use of high and low-infrastructure stations. In conclusion, we observed that large predator activity was reduced by high human infrastructure, releasing herbivores from a landscape of fear, while leaving mesopredators relatively unaffected.

BBB47 - The impact of feral hogs on the forest understory in the North Carolina piedmont

Tobias Mielke

Catawba College, salisburry, NC

Feral hogs, *Sus scrofa*, a non-native, invasive species that have been known to occur in the central piedmont of North Carolina since approximately 2012. centered on a putative illegal hog release event in Davie County, NC near the confluence of the Yadkin River and South Yadkin River. The feral hogs spread quickly to neighboring Rowan County. Three - 5 x 5 meter hog exclosures were placed on property in Rowan County owned and managed by the Three Rivers Land Trust in spring 2015, forest floor vegetation sampling in the exclosures and adjacent control plots occurred in Fall 2015 and 2023. Stem density, species richness, and beech sampling height were measured eight years after the exclosures were established. Statistically significant reductions in the understory vegetation stem count and the tallest beech saplings measured, were observed in the fall 2023 data due to hog activity. Impacts of hog browsing and rooting may influence future plant community structure and trajectory.

BBB48 -

Drone-based Thermal Imaging Techniques and Tools for Feral Swine Population Management in the NC Piedmont

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[1]Catawba College, salisburry, NC, [2]Catawba College, salisbury, NC

Feral swine, *Sus scrofa*, a non-native, invasive species with an estimated population size of 6-9 Million in the Southeastern US, present an ecological, health, and economic threat across North Carolina landscapes. With many detrimental habits such as rooting and crop-eating, feral swine present a serious threat to the economy and the environment. With the engagement of collaborative partners ranging from state and federal agencies, non-profit organizations, and private landowners, we seek to expand our knowledge of and address management for feral swine throughout the Yadkin-PeeDee River Basin. This project will dovetail with ongoing collaborative efforts

of the North Carolina Department of Agriculture and Catawba College to reduce feral hog populations through intensive trapping on property along the Yadkin River. In 2018, Three Rivers Land Trust helped conduct a drone-based thermal survey for hogs was conducted on 'the point property.' This project seeks to use drones and thermal sensors to redo the 2018 hog survey for two purposes: 1) to better understand the capacity and limitations of drones and thermal sensors for detecting feral swine, and 2) to determine how the hog population has changed since the prior survey and with the advent of the intensive trapping program.

BBB49 - Detection of Bacterial Pathogens in Tarballs Collected from the Alabama Gulf Coast

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Tarballs are solid to semi-solid petroleum globules formed by weathering of crude oil from oil spills or natural oil seeps in marine environments. Some tarballs are light and small enough to float on water and travel by wind and ocean currents. They contain various petrochemicals including benzene, toluene, xylene, polycyclic aromatic hydrocarbons (PAHs), heavy metals, and sulfur. This peculiar condition of tarballs allows a different set of microorganisms to proliferate. Plentiful research has shown the presence of oil-degrading bacteria in tarballs, while only a few studies have been conducted on the pathogenic bacteria in tarballs. In this research, DNA samples of tarballs collected from the Alabama Gulf coast were extracted and PCR analysis was conducted using primers targeting 15 genera of waterborne bacterial pathogens. This is a still ongoing project and final results will be available by the time of the conference.

ASB Fieldtrips

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Meeting-At-A-Glance
Association of Southeastern Biologists 2024
Wednesday, March 20 – Saturday March 23, 2024

Wednesday, March 20

Time	Event	Location
9:00 am - 4:00 om	Exhibitor Set-uo	Hall C
11:00 am - 9:00 pm	Registration Open	Hall C Foyer
11:00 am - 2:00 om	Exhibitor's Coffee **Break** (exhibitors only)	Hall C
1:00 om - 2:00 om	ASB Executive Committee Meeting	Hall C
2:00 pm - 4:00 pm	SABS Executive Council Meeting	Room 18
6:30 pm - 7:30 pm	**WELCOME AND PLENARY** Welcome: ASB 2024 R.H. Martin Plenary Speaker I Karen Lloyd	Room EFG
7:30 pm - 9:00 pm	Welcome Reception - Ticketed Event	Hall C

Thursday, March 21

Time	Event	Location
7:00 am - 5:00 pm	Registration Open	Hall C Foyer
7:00 am - 8:00 am	ASB Past President's Breakfast Meeting	Room 17
7:00 am - 5:00 om	PowerPoint **Preview** Check - Lightning Talks	Hall C
8:00 am - 9:30 am	**ASB POSTER PRESENTATION MORNING SESSION** Presenters are asked to stand with their poster during one session	Hall C
8:00 am - 5:00 om	Exhibits Ooen	Hall C
8:00 am - 10:00 am	Coffee Break Service	Hall C
9:30 am - 10:00 am	Lightning Talks	Hall C
9:30 am -11:30 am	Workshop: The Only Constant is Change: Programmatic Workflows to Access Preoare. and Work with NEON Data	Room 3
10:00 am - 12:40 pm	SYMPOSIUM: Southeast Chapter of the Ecological Society of America - Climate Change Ecology in Southeastern Systems	Room4
10:00 am - 12:00 pm	SYMPOSIUM: Fire History and Fire Effects in Southeastern U.S. Ecosystems-Implications for Management	Room 2
10:15 am -11:l5 am	Workshop: Honey I Blew Up the Molecules: 3D Printing as a Multi-faceted and Multi-disciplinary Pedagogical Practice	Room 11
10:15 am -11:45 pm	**TALK SESSION 1** GENETICS AND CELL & MOLECULAR BIOLOGY PLANT SYSTEMATICS CONSERVATION GENETICS ECOLOGY: ECOSYSTEMS AND LANDSCAPES ECOLOGY: PHYSIOLOGICAL ECOLOGY: AQUATIC A	 Room 6 Room 5 Room 12 Room 13 Room 14 Room 15

11:45 am - 1:00 pm	TRIBETA Joint Business Meeting and Mixer (all delegates MUST attend)	Room 11
12:00 pm - 1:30 pm	Lunch ASB Diversity Committee ASB Education Committee SABS/BSA Members Lunch	 Room 17 Room 18 Room 3
1:30 pm - 3:30 pm	WORKSHOP: Hitting the Ground Running with Your Graduate School Applications --Hosted by ASB's Human Diversity Committee	Room 2
1:30 pm - 2:30 pm	WORKSHOP: Stories from the Field: Best practices for Field Experiences	Room 3
1:30 pm - 3:00 pm	**TALK SESSION 2** MICROBIOLOGY PLANT FLORISTICS ANIMALS: ENTOMOLOGY A ANIMALS: HERPETOLOGY ECOLOGY: CONSERVATION A ECOLOGY: COMMUNITIES A SCHOLARSHIP OF TEACHING AND LEARNING	 Room 6 Room 5 Room4 Room 12 Room 13 Room 14 Room 15
2:45 pm - 4:15 pm	WORKSHOP: Our redesigned and revamped Eastern Biologist journal-eBio	Room 3
3:00 pm - 5:00 pm	Coffee Break Service	Hall C
3:00 pm - 3:30 pm	Lightning Talks	Hall C
3:30 pm - 5:00 pm	**ASB POSTER PRESENTATION AFTERNOON SESSION** Presenters are asked to stand with their poster during one session TriBeta Posters	Hall C
5:15 pm - 6:15 pm	SABS/BSA Student Reception	Marriott - Tennessee Room - 1st Level
6:45 pm - 11:00 pm	**Transportation to the Social revolving in front of the Marriott hotel 11th Street.**	Marriott - 11th Street
7:00 pm - 11:00 pm	**Thursday NIGHT SOCIAL** - Ticketed Event Live Music, Food, Drinks, Games	Tennessee Aquarium

Friday, March 22

Time	Event	Location
7:00 am - 12:00 pm	Registration Open	Hall C Fover
7:00 am - 5:00 pm	PowerPoint Preview Check - Lightning Talks	Hall C
8:00 am - 9:30 am	**ASB POSTER PRESENTATION MORNING SESSION** Presenters are asked to stand with their poster during one session TriBeta Posters	Hall C
9:30 am - 10:00 am	Lightning Talks	Hall Ck
8:00 am - 10:00 am	Coffee **Break** Service	Hall C
7:30 am - 6:00 pm	TRIBETA Officers & Judges Room	Room 16
9:30 am-12:00 pm	SYMPOSIUM: Conservation of Southern Appalachian Salamanders	Room 2

10:15 am - 11:30 am	TRIBETA SESSION 1	Room 11

10:15 am - 11:45 am	**TALK SESSION 3** GENETICS AND CELL & MOLECULAR BIOLOGY B PLANT COLLECTIONS AND HERBARIA ANIMALS: ENTOMOLOGY B ANIMALS: BEHAVIOR A ECOLOGY: CONSERVATION B ECOLOGY: COMMUNITIES ECOLOGY: AQUATIC B	 Room 6 Room 5 Room4 Room 12 Room 13 Room 14 Room 15
10:00 am -12:00 pm	WORKSHOP: Social Field Safety : Being more inclusive and understanding risks for marginalized and historically excluded individuals who professionally **work** outdoors	Room 3
12:00 pm - 1:30 pm	SHC SE Chapter Lunch and Business Meeting ESA Lunch and Business Meeting	Room 17 Room 18
1:30 pm - 2:45 om	TRIBETA SESSION 2	Room 11
1:00 om-3:55 om	SYMPOSIUM: Women in Bioloi;rv Insoired bv Women in Bioloe:v	Room4
1:30 pm - 3:00 pm	WORKSHOP: Fulbright Opportunities for Biologists	Room 3
1:30 pm-2:45 pm	**TALK SESSION 4** GENETICS AND CELL & MOLECULAR BIOLOGY B ANIMALS: ENTOMOLOGY C ANIMALS: BEHAVIOR B ECOLOGY: CONSERVATION C ECOLOGY: POPULATIONS SCHOLARSHIP OF TEACHING AND LEARNING	 Room 6 Room 5 Room 12 Room 13 Room 14 Room 15
1:30 pm - 3:00 pm	SYMPOSIUM: Memoirs in Aquatic Biology: A Tribute to Dr. Mark Schorr-Teacher, Mentor, and Scientist	Room 2
3:00 om - 5:00 om	Coffee **Break** Service	Hall C
3:00 pm - 3:30 pm	Lightning Talks	Hall C
3:30 pm - 5:00 pm	**ASB POSTER PRESENTATION AFTERNOON SESSION** Presenters are asked to stand with their poster durinR: one session	Hall C
5:00 pm - 6:00 pm	TRIBETA Joint Session and Awards	Room 11
5:00 pm - 6:00 pm	ASB Members Meeting (All ASB members invited)	Room 12
7:00 pm - 9:00 pm	**ASB AWARDS BANQUET** - Ticketed Event	Room EFG

Saturday, March 23

Time	Event	Location
7:00 am - 4:00 pm	**FIELD TRIPS**	
7:00 am -12:00pm	EC Breakfast and meeting (for Current and Incoming EC members only)	EastlWest Room

Publish With ASB-Affiliated Journals

eBio (ISSN 2165-6657), is a peer-reviewed official journal of ASB that publishes original articles and notes focused on the biology of organisms as it relates to the structure, function, and development of their internal systems, and as it pertains to their use in medical and other applications not directly related to the ecology and conservation of species or their habitats.

The Southeastern Naturalist (Print ISSN #1528-7092 and Online ISSN # 1938-5412) is a peer-reviewed official journal of ASB that publishes original articles focused on natural history research related to all aspects of the biology and ecology of terrestrial, freshwater, and marine organisms and the environments of the southeastern portion of North America.

ASB 85th Annual Meeting

Chattanooga, TN

March 20-23, 2024

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Serious science in a welcoming space